# ISO 14001 CERTIFICATION - A COST BENEFIT ANALYSIS WITHIN THE SOUTH AFRICAN MANUFACTURING SECTOR

by

**Lawton Warren Johnson**

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Supervisor: Professor Tracey McKay

Co-supervisor: Ms Deborah Machard

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# DECLARATION

Name: Lawton Warren Johnson

Student number: 7352573

Degree: M.Sc Environmental Management

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Limitation

The sampling was done in twenty (20) manufacturing companies across three metros in the Eastern Cape Province [Nelson Mandela Metropolitan Municipality, which includes Port Elizabeth and Uitenhage, as well as Buffalo City Municipality, which includes East London] and the Kwa-Zulu Natal Province [the Ethikweni Municipality which includes Durban and surrounding areas] of South Africa. The selected companies were those who have fully implemented an EMS and who have been certified to the requirements of ISO 14001 by accredited certification bodies such as the South African Bureau of Standards (SABS) and others.

I declare that the above dissertation/thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

**28 October 2018**

SIGNATURE DATE

## ABSTRACT

Companies in South Africa who have implemented the ISO 14001 environmental management system have claimed that it offered benefits such as an improved environmental performance and a business advantage. However, to date the commercial benefits associated with ISO 14001 in South Africa have not been quantified so the claims of a financial advantage cannot be verified. This study therefore sought to assess the financial benefits accruing to various manufacturing enterprises in Kwa-Zulu Natal, the Eastern Cape and the Western Cape provinces of South Africa who have implemented ISO 14001. There was a particular focus on determining the cost savings and return on investment which resulted from the purchase of 'environmentally friendlier' raw materials; the reduction of process waste (by the reuse, reduction and recycling of waste) as well as the more efficient use of resources such as electricity, water and fuel. Data was collected by means of a questionnaire survey sent to key decision makers in the selected organisations, as well as follow-up in-depth interviews with selected individuals within each organisation. The results of the study showed that the benefits of ISO 14001 certification included improved environmental awareness among employees; enhanced responsibility for environmental concerns by employees; better data management; reduced operational and production costs; and new income streams linked to re-use and recycling initiatives. Consequently it can be said that the long-term financial benefits justify the relatively high cost; the time intensive obligations and the human resource requirements of ISO 14001 certification. That said, it was also found that smaller companies face relatively more financial hurdles in implementing an EMS, and thus, it is recommended that tax incentives for such firms to implement and EMS be considered.

## DEDICATION

To my wife, Ionia and our daughters Jaime and Lesley for being there for me with their steadfast love, their support, continuous encouragement and belief in me.
Thank you for your patience and for tolerating my sometimes antisocial behaviour.

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## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AIDC | Automotive Industry Development Agency |
| BRICS | Brazil, Russia, India, China, and South Africa |
| BSI | British Standard Institutes |
| BVQI | Bureau Veritas Quality International |
| CSIR | Council for Scientific and Industrial Research |
| DEAT | Department of Environmental Affairs and Tourism |
| DQS | Deutsche Gesellschaft zur Zertifizierung von Managementsystemen |
| EMP | Environmental Management Plan |
| EMS | Environmental Management System |
| EMAS | Eco-Management and Audit Scheme |
| ISO | International Standards Organisation |
| IWMSA | Institute of Waste Management of Southern Africa |
| NEMA | National Environmental Management Act 107 of 1998 |
| SEMA's | Sector-specific National Environmental Management Acts |
| SABS | South African Bureau of Standards |
| SMME | Small, Medium and Micro Enterprises |
| TQM | Total Quality Management |
| KPMG | Klein Pit Marwick Goodlign |
| OHSAS | Occupational Health and Safety Assessment Specification |
| PWC | Price Waterhouse Coopers |
| SGS | Schweiz Vereinigung fur Quallats and Management System |
| SMME | Small, Medium and Micro Enterprises |
| WCED | World Commission on Environment and Development |
| WICEM | World Industry Conference on Environment Management |
| WTO | World Trade Organisation |

## DEFINITION OF KEY TERMS

**International Organization for Standardization (ISO):** ISO, based in Geneva, Switzerland, is a worldwide federation of national standards bodies (ISO member bodies) whose work is carried out through ISO Technical Committees.

**ISO 14000**: a system of 20 separate Environmental Management Standards designed to help organisations to establish management process for controlling and improving their environmental performance.

**ISO 14001**: The ISO 14000 standard that was developed as the only specification or registration standard for organisations that wish to improve their environmental performance

**Certification**: The attainment of a certificate for fulfilling all the requirements by an organisation as specified by the applicable ISO standard

**Environmental Management:** Environmental management is defined as a process which attempts to control the negative impact humans have on the environment to preserve natural resources.

**Environmental Management System**: the structure and framework used to manage environmental impacts on a continuous basis, in this study; it refers to structures and /or frameworks developed by companies.

**Environmental aspects and impacts:** Environmental aspects are those modes, comprising either spills; chemical releases; air emissions; water usage and energy usage of an organisation's activities, products or services which can interact with the environment. The ISO 14001 standard requires an organisation to identify the environmental aspects of its activities, products, or services in order to identify those that could have significant impacts. The standard prescribes neither what aspects should be significant, nor how to determine significance. However, it is envisaged that a coherent and demonstrable method is utilised to determine the significance of these aspects and its associated impacts.

# CHAPTER 1: INTRODUCTION

## 1.1 Introduction

Environmental matters appear to be one of the weightier subjects under consideration in the globalised industrial world of today. Pollution, which is generated because of emissions, effluence, soil contamination, and dumping into water/air resources, exerts negative impacts on the environment throughout the world. As a result, organisations are under pressure to assessing how their processes and activities affect the environment and become more environmentally responsible (BSI, 2009).

Organisations may however, consider environmental compliance to be an additional cost that negatively impacts their financial bottom lines, but both recycling and pollution prevention programmes can reduce or eliminate waste, and may, in turn, engender meaningful financial savings. In addition, increasing worldwide public activism has resulted in manufacturers, such as automotive manufacturers, demanding environmental compliance from their suppliers (Gilbert-Miller 2001), as future sales may be dependent on being able to demonstrate that the company takes their environmental responsibilities seriously (Forbes, 1999). For this reason, organisations need to consider how they are affecting the environment, and take into consideration that their very business survival is dependent on changing the way they operate. That is, business as usual is unsustainable. In this regard, companies can consider adopting ISO 14000 environmental standards to help them become more environmentally sustainable.

A study by Aba and Badar (2015) recognizes the International Organization of Standardization (ISO) as a partnership of non-governmental organisations which was constituted during the year 1947 in Geneva, Switzerland. The study contends that ISO was formed with the primary goal to formulate industrial and quality standards which could be accepted internationally, (Aba and Badar 2015). They posit that purpose of ISO is to ensure that common parameters were codified and executed from product and service design and development stages through to production, processing and on-going service and maintenance functions of companies (Aba and Badar 2015). According to Brunsson, & Jacobsson, (2000) this partnership was established with the common purpose of formulating these global standards to enable the trading of goods and services as well as to expand co-operation and the exchange of technology across regional

and international borders. To date more than 14 000 ISO standards relating to both products as well as management systems have been published (Arana 2012). According to Blind (2004), standardization therefore played a vanguard role in the subsequent growth and expansion of the industrial society globally. It has become integral in the core management systems and processes that have been developed and implemented to production and service provision (Heras-Saizarbitoria and Boiral, 2013).

The ISO 9000 range of Quality Management Systems (QMS) was first published in 1987 and reviewed in 1994 and 2000, with the latest revision published in 2015 (Wilson, Walsh & Needy, 2003). They are designed to assist organisations to launch and implement their internal quality assurance management systems (Pantouvakis and Dimas 2010). According to Morris (2004) and Delmas & Montiel, (2008), the ISO 14000 family that comprises the environmental management standards, was constructed because of the success of ISO 9000 as well as in response to the universal concern regarding the environment. It was developed by ISO in order to provide guidance to organisations who wished to advance its environmental performance and it offers a framework for the effective management of the organisation's environmental programme that commits to objectives (Edwards, Gravender, Killmer, Schenge and Willis, 1999). They further identified ISO 14001 as the standard that embodies the strategies for an effective Environmental Management Systems (EMS). This was motivated by the General Agreement on Trade and Tariffs (GATT) of 1996 and the Rio Agreement of the UN Conference of 1992. These came into being largely due to the prompt global acceptance of ISO 9000 as well as the propagation of environmental standards that obliged the ISO to gauge the need for environmental management standards able to meet these global requirements (Edwards *et al.*, 1999).

Although there are some serious problems with ISO 14001. With Rukato (2000) reporting that ISO 14001 is expensive and time-consuming. Ammenberg and Sundin (2005) contend that the ISO 14001 registration process is long and costly, but if the ISO 14001 management system is effectively designed, planned and implemented, it can provide a company with a competitive edge as it should lead to a reduction in bottom line costs (Batts, 1999). In particular, according to Rondinelli and Vastag (2000), companies have reported that the implementation of ISO 14001 has provided them with improved operational efficiencies, increased awareness amongst both management and employees about environmental issues,

and economic benefits. Thus, the system has become a global yardstick against which comparable measurements can be determined. Therefore, as argued by Curkovic, Sroufe and Melnyk (2005), it can be said that the ISO 14001 Environmental Management System (EMS) is premised on the assumption that environmental improvements will ultimately lead to improved overall business accomplishments.

## 1.2 What is ISO 14000?

According to Babakri, Bennet and Franchetti (2003), the ISO 14000 environmental management codes are made up of a series of 20 separate Environmental Management Standards (EMS). Each of these is designed to assist organisations with regards to management processes that will control and improve a company's environmental performance. From an environmental management perspective, the most important of the standards is ISO 14001. ISO 14000 provides the framework for establishing an EMS (BSI, 2015). It is the only standard that can be used in EMS certification, as all the other standards in the 14000 series function in a supporting role to augment the effectiveness of ISO 14001 (Warries, 2004). Consequently, ISO 14001 has become an international benchmark by which companies can voluntarily develop, assess and improve their environmental practices. The ISO 14001 standard covers all the facets of implementing an EMS, ranging from the establishment of an EMS policy document, to identifying the various environmental aspects that need undertaking, defining what training will be required, stating objectives and targets, monitoring and measuring, internal audits, and management review.

### 1.2.1 Purpose of ISO 14001

As per Yiridoe & Marret (2004), the principal goal of the ISO 14001 standard is to improve and develop compliance and adherence to environmental laws and regulations. They further contend that the overall aim of ISO 14001 is to sponsor environmental protection and to prevent pollution. The document states: "*demonstration of successful implementation of this International Standard can be used by an organization to assure interested parties that an appropriate environmental management system is in place*", (ISO 2004 p. (v)). In addition, it enhances those policies of organisations that encourage environmental stewardship.

However, it must be borne in mind that these environmental stewardship programmes cannot be managed in a vacuum as they come at a cost.

### 1.2.2 Benefits of ISO 14001

According to Curkovic, *et al.* (2005), the ISO 14001 standard assumes that better environmental management leads to improved operational and financial performance. However, the true commercial value associated with ISO 14001 is only achievable when the EMS is used to formulate a company's strategic decisions (Curkovic *et al.,* 2005). Rondinelli and Vastag (2000) confirmed the contention of Batts (1999) above, reporting positive impacts for organisations that have implemented ISO 14001, such as improved operational efficiency, employee environmental awareness and commercial competitive benefits. According to Fryxell, Lo and Chung (2004), companies opt for certification to ISO 14001 for a number of reasons. These are: (a) to improve their compliance to statutory and regulatory requirements; (b) increase their market share; (c) reap the benefits of premium pricing within certain market segments; (d) respond to customer pressure; (e) improve access to new markets; (f) improve efficiencies; (g) reduce costs; and (h) enhance their reputation. Singh, Brueckner and Padhy (2015) posited that it also results in better quality organisational management; improved internal and external process communications; employee motivation; and a better organisational image. EMS further offers improved overall management performance by assisting companies to reduce pollutants emitted by production operations, and improved waste management. ISO 14001 has been found to be particularly valuable as an EMS standard because its systematic nature, resource efficiency, pollution prevention and better waste management result in financial benefits. However, Ghissellini and Thurston (2005) and Rondenelli and Vastag (2005) claimed that some companies only register for ISO 14001 to use it as a marketing tool or to improve their corporate image.

Conversely, Babakri *et al*. (2003) argued against the implementation of an EMS. They noted that ISO 14001 must be viewed within the context of an organisation's environmental policy, as the adoption of the ISO 14001 guidelines will not automatically guarantee optimal environmental outcomes. Rukato (2000) further maintained that ISO 14001 is time-consuming and expensive, with a lengthy and costly registration process. ISO 14001 companies can also become complacent and not adhere to the standards as they were

originally intended (Ammenberg & Sundin, 2005). As noted by Godshall (2000), the wholesale criticism against the ISO 14001 standard originates from the opinion that certification is essentially a drill in the creation of an inordinate volume of unnecessary paperwork. ISO, (2004) notes that the success of the system is dependent on an organisation-wide buy-in including top management.

### 1.3 ISO 14001 within the South African context

Although some environmental laws were in force prior to the enactment of the 1996 South African Constitution, the Constitution (Chapter 2) firmly entrenched environmental protection as a human right for the first time. In addition, Section 24 also imposes a constitutional duty on the state to protect the environment through reasonable legislative and other measures (van der Linde, 2006). The Constitution of the Republic of South Africa provides the overarching context of environmental law by underscoring that:

*"Everyone has the right – (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that – (1) prevent pollution and ecological degradation; (2) promote conservation; and (3) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development"* (Constitution of the Republic of South Africa, 1996).

Building on and supporting the Constitution are the Environmental Conservation Act 73 of 1989 and the National Environmental Management Act (NEMA), Act No 107 of 1998, which provide the overarching legislative framework for environmental governance in South Africa, and significantly increase the environmental demands imposed on organisations (Barker *et al*., 2004).

Several sector-specific National Environmental Management Acts (SEMAs) have also been promulgated, covering energy, air, water and waste.
Regulations made under NEMA:

1. EIA Regulations in GN R982 - 4 December 2014;

2. Listing Notice 1 of 2014: List of Activities and Competent Authorities identified in terms of section 24(2) and section 24(D), in GN R983 - 4 December 2014;
3. Listing Notice 2 of 2014: List of Activities and Competent Authorities identified in terms of section 24(2) and 24(D), in GN R984 - 4 December 2014;
4. Listing Notice 3 of 2014: List of Activities and Competent Authorities identified in terms of sections 24(2) and 24(D), in GN R985 - 4 December 2014;
5. EMF Regulations promulgated in GN R547 - 18 June 2010.

All the these Regulations replaced the previous EIA Regulations and came into effect on 8 December 2014

Some of the specific South African legislation related to the environment, which is applicable to industry, includes[1]:

1. Constitution of the Republic of South Africa, Act 108 of 1996, Bill of Rights - Chapter 2 of the Constitution of the Republic of South Africa, 1996
2. Agricultural Pests Act, No 30 of 1993
3. Atmospheric Pollution Prevention Act, No 45 of 1965 (repealed)
4. Environmental Conservation Act (ECA), No 73 of 1989 (repealed)
5. Fertilisers, Farm Feeds Act, No 36 of 1947
6. Hazardous Substances Act, No 15 of 1973
7. Mineral and Petroleum Resources Development Act, No 28 of 2002
8. National Energy Act, No 34 of 2008
9. National Environmental Management Act ("NEMA"), No 107 of 1998
10. National Environmental Management: Air Quality Act, No 39 of 2004
11. National Environmental Management: Waste Act, No 59 of 2008
12. National Water Act, No 36 of 1998
13. Nuclear Energy Act, No 46 of 1999
14. Occupational Health and Safety Act, No 85 of 1993
15. Promotion of Access to Information Act, No 2 of 2000

Thus, it could be argued that South Africa has a large set of environmental legislation, as McGarity (2004, p. 529) described environmental legislation as *"....regulatory in nature;*

[1] Note that this list is not exhaustive.

*they are designed to change private conduct in ways that will help preserve and protect human health and the environment. Such laws invariably delegate the details of implementation to a regulatory agency that is empowered to set standards, write regulations, and issue permits, all of which are designed to protect the environment to some degree*". According to Sands (1990, p. 688), the application of environmental regulation is designed *"…(1) to preserve, protect and improve the quality of the environment; (2) to contribute towards protecting human health; (3) to ensure a prudent and rational utilization of natural resources".*

The point of departure for NEMA is a set of National Environmental Management Principles, which inform any subsequent environmental legislation, implementation of that legislation and the formulation and execution of environmental management plans at all levels of government (Constitutional Assembly, 1996). Although all organisations in South Africa have to comply with the provisions of the legislation, only those companies that have ISO 14001 certification are audited by certification bodies at regular intervals to assess whether their systems and processes are compliant with statutory, regulatory and ISO 14001 requirements. Within this legislative context, certification to ISO 14001 is an option. Nevertheless, one that should be encouraged as commitment from the implementing organisation, coupled with the experience of a certification body, can help companies realise considerable benefits, (de Vries *et al.*, (2012). Esser (2011) concurred, arguing that the sustainability practices are embedded in the Companies Act 71 of 2008, as well as the King III (2009) report, thus, adopting ISO 14001 will assist companies to comply with the Companies Act and the King III (2009) codes. Furthermore, Engel (2008) claims that green economy objectives can stimulate economic growth.

In a summary of the King Report on Governance for South Africa by the Institute of Directors Southern Africa (IODSA 2009), the authors assert that the King III report places pronounced prominence on Leadership; Sustainability; and Corporate Citizenship. They further posit that the significance of the notions of integrated sustainability and social transformation is emphasized in the report and that it points to an on-going focus on the impacts of organizations and its activities on communities and the environment. The IODSA report continues the argument that the concept of sustainability was intricately linked with the evaluation of the ethics as well as the improvement of ethical standards in both the business

spheres as well as in the community it operates in. According to the IODSA report, the Minister of Environmental Affairs has pointed out that, unless measures are adopted, greenhouse gas emissions in South Africa will quadruple by 2050, which would result in South Africa becoming a pariah nation. They continue to note that sustainability reporting was also emphasised in the King III report in order to utilise suppliers from amongst previously disadvantaged people. They agree that the success of companies in the 21st century was likely to involve the natural environment; the social environment; the political system; and the global economy (IODSA 2009).

Hatch and Hounsome (1998), using an analysis by the CSIR undertaken in 1998 on 140 South African companies, confirmed that environmental legislation has played a significant role in the improved commitment of companies toward environmental issues. The above argument was corroborated by Mbadlanyana (2013), who affirmed that the 2004 report of the South African Department of Environmental Affairs and Tourism (DEAT) outlined that stringent environmental laws will help energy-intensive, electricity-generating and oil refinery companies to reduce their greenhouse gas emissions. As argued by Hesloop (2006), South Africa is the largest producer of carbon emissions in Africa, thus by introducing green air quality legislation, a paradigm shift in the promotion of green policies and subsequent planning in companies will be experienced. As a result, it can be perceived that the attitude of the South African government towards constructing a green economy has contributed to the introduction of environmental legislation, positively influencing the behaviour of companies through the broadened embrace and implementation of management programmes that are more environmentally friendly.

## 1.4 Problem Statement

As argued by Campos, Melo, Verdinelli and Miguel (2015), various studies have shown that an EMS such as ISO 14001 improves an organisation's overall performance. This performance includes environmental, operational and financial indicators. Academic studies in Brazil, Russia, India, China and South Africa (see Perotto, Canziani, & Butelli, 2008; Campos & Melo, 2008) have explored the effects on companies that are certified to ISO 14001, finding that their overall performance has been improving (ISO/Survey, 2014). While Matela (2006) looked at the effects of ISO 14001 on environmental performance, none of the

other benefits such as improved productivity, a reduction in waste generation, a reduction in energy usage, a reduction in the use of natural resources, the reuse of scrap material and the recycling of waste have been documented in South Africa. However, there is little published work on the financial and other benefits that can accrue to South African organisations who have adopted ISO 14001.

The intention of this study is, thus, to focus on and quantify the financial and other benefits (such as regulatory compliance, increased awareness regarding the environment, improved overall management practices and natural resource protection) associated with the implementation of an EMS (ISO 14001) in various selected manufacturing companies. In particular, companies that have been certified by the South African Bureau of Standards (SABS) and other certification bodies such as DQS, Bureau Veritas, TUV Rheinland and others, to be ISO 14001 compliant, were selected. The study will therefore be valuable in quantifying the economic spin-offs that companies have experienced because of effective implementations of ISO 14001.

## 1.5 The aims and objectives of the study

The aim of this study was to assess the financial benefits for various organisations, in different manufacturing sectors (such as the chemical, engineering, rubber and plastics, food and automotive industries) that have been certified to ISO 14001(EMS). The main objective was to determine if the adoption of an ISO 14001(EMS) made good business sense. The study sought to analyse and evaluate economic benefits. These include cost savings resulting from the purchase of environmentally friendlier raw materials, the reduction of process waste and the more efficient use of resources such as electricity, water, steam, gas and fuels, as well as the reuse, reduction and recycling of waste associated with the adoption and implementation of ISO 14001.

## 1.6 Research Questions

To assess the economic and financial benefits as listed above, the study had the following research questions:

Research Question 1:

What drove the observed companies to implement an ISO 14001 EMS?

Research Question 2:

Did the implementation of an EMS improve process efficiency?

Research Question 3:

Did the implementation of an EMS improve environmental awareness within the companies under study?

Research Question 4:

Did the implementation of an EMS have financial benefits?

All of the above research questions were covered in the survey questionnaire, using information type, category, multiple choice, and open-ended questions. In addition, follow-up interviews were conducted with a selected sample of respondents in order to elicit further information to confirm the results of the survey questionnaire.

## 1.7 Research Design and Methodology: An overview

The study adopted a mixed methods research design where data were collected in two stages. Stage One used the quantitative method which involved the use of a questionnaire (which included both closed -and open-ended questions), which was distributed primarily electronically via email to the selected participants. The responses obtained from the completed questionnaires were collated, statistically analyzed, and graphically represented. Inferences were drawn from the statistics to provide conclusions, and then recommendations were developed.

In Stage Two, a representative sample (60% to 70%) of the respondents from Stage One were approached via telephone or email for one-on-one, in-depth interviews in order to understand the internal challenges more fully, and to allow for a more comprehensive analysis of the concerns that had been highlighted. A representative sample was selected as, according to Clark and Ivankova (2015), "it is one that has strong external validity in relationship to the target population the sample is meant to represent." It further posits that researchers are not concerned in the sample itself, but rather in the insight that they can possibly conclude from the sample (Clark and Ivankova 2015). All the interviews were conducted with personnel

who were involved in the implementation and management of the EMS in their respective companies.

## 1.8 Description of Study Sites

The study involved 20 manufacturing companies across three metropolitan areas. Two in the Eastern Cape Province, i.e. the Nelson Mandela Metropolitan Municipality (NMB) (which includes Port Elizabeth and Uitenhage), and Buffalo City Municipality (BCM) (which includes East London), one in eThekwini Municipality which includes Durban and its surrounding areas) in Kwa-Zulu Natal Province, as well as one city, George, in the Western Cape Province. The selected companies had all fully implemented an EMS and had been certified to the requirements of ISO 14001 by accredited certification bodies, such as the South African Bureau of Standards (SABS). The informants for the study were employees at the management and supervisory levels of the various certified companies. This target population were individuals who were directly involved in the EMS implementation process.

## 1.9 Chapter Overview

This study is comprised of seven chapters:

Chapter 1: Introduction - provides the background to the fundamental principles and guidelines that govern the implementation of an environmental management system. It introduces the rationale, goals and objectives of the study, as well as the context, scope and methodology employed to achieve the objectives, and lastly the definition of terms.

Chapter 2: Literature Review - gives an account of the accredited researched scholarly work that has been published on the research topic. The focus is on discussing the published information on the subject area in order to confirm that the researcher had read the main published work concerning the research project, and had therefore developed a good understanding of the fundamental aspects.

Chapter 3: Research Methodology - describes the approach and design of the study and the methods employed in the process of collecting the research information and data required for

constructing the dissertation. This includes the strategies, instruments and data collection, as well as the techniques used to analyze the collected data, in order to draw reasonable statistical inferences and make decisions. It considers the validity and reliability of the methods used, and consequently the data collected.

Chapter 4: Results of the email survey– this chapter presents the collected data from the survey questionnaires in an organised and statistically analysed form in order to provide a graphical tool that allows for the logical and effective interpretation of the data and to formulate strategies. The discussion of the data findings ends this chapter.

Chapter 5: Results of in-depth interviews – in this chapter the research information from the one-on-one interviews is presented, interpreted and discussed in an open, logical, comprehensive and unbiased manner, which results in opinions being postulated.

Chapter 6: Discussion of study results - this chapter discusses the interpretations of the information and inferences of Chapters 4 and 5 and presents the inferences that can be drawn from both the analysis of the results from the previous two chapters as well as the objectives of the study in consideration of the literature review in chapter 2.

Chapter 7: Recommendations, Advices & Conclusion - this chapter focuses on the interpretations of the findings, the discussion and recommendations of Chapters 4, 5 and 6 to draw conclusions and formulate subsequent recommendations and advices for further research which may be of benefit to the organizations sampled for the project, as well as for other companies that have implemented an EMS or which may contemplate doing so.

### 1.10. Conclusion

Media focus, coupled with the emergence of influential individuals and civic organisations championing environmental awareness, has resulted in concern for the environment growing daily. Historical and on-going scientific research indicates that damage to the environment is linked to ever-increasing economic demands, which in turn are causing the consumption of the world's natural resources while polluting land, water and air. Humanity has become its own worst enemy, as the technological advances that make our lives easier and extend our

life expectancy are negatively affecting the resources we need to sustain us. We therefore have to be smart enough to change our paradigm and find ways to minimise the negative impact we have on the environment, both as individuals as well as corporations. This research aimed to look in-depth at those South African organisations that have already implemented an EMS in order to determine if there are benefits to the adopt of more environmentally sustainable manufacturing processes.

In the following chapter, the literature study provides the background to the environmental standard, the reasons why the implementation of this standard makes economic sense, as well as the benefits associated with the successful implementation thereof.

# Chapter 2: Literature Review

## 2.1 Introduction

This chapter examines the applicable scholarly literature, including a summary of the history of the International Standards Organisation (ISO) and a clarification of the interaction of management standards ISO 9001 and ISO 14001. It further presents a summary of the ISO 14001 environmental management standard, its background and growth, as well as its features and benefits. In addition, it reports on studies that argue that the ISO 14001 environmental management standard is a useful tool with regards to enhanced operational, economic and financial gains, which subsequently results in value-add to a company's bottom line as well as a competitive benefit. The discussion continues with an evaluation of the South African experience, where an outline of the South African environmental legislation is presented followed by an assessment of the impact of an EMS implementation in companies that have been certified to ISO 14001 in South Africa. From the normative viewpoint, Perotto *et al.* (2008) defined ISO 14001 as a combination of connected components functioning as sections of an inclusive management system, which companies use to craft their environmental policy statements and to manage the environmental aspects associated with their processes (ISO, 2004; Campos *et al.*, 2015).

When standardisation originated in the early part of the 20th century, it was introduced primarily to restrict the inefficient discrepancy in the quality of parts, components and supplies on the one hand, and to foster their interchangeability in order to enable the mass production as well as the maintenance and repair of goods and services on the other (Arana, 2012). Standardisation has advanced beyond this initial idea, however, and has become integral in its application to the core management systems and processes that are developed and implemented to produce products and provide services (Heras-Saizarbitoria & Boiral, 2013). Brunsson and Jacobsson (2000) described standardisation as standards for organisational practises, while Furusten (2000) referred to them as benchmarks that have been developed on how organisations can be designed and managed. These administrative standards have been identified and defined as Management System Standards (MSS), which Uzumeri (1997) referred to as meta standards. These two terms have already been accepted in academic jargon, according to Corbett and Yeung (2008) as well as Heras-Saizarbitoria and Boiral (2013).

Braun (2005) indicated that these MSSes must be differentiated from the technical rules and requirements applicable to individual products or processes.

## 2.2 Environmental Management

According to Kessler, van Ginniken, Cornelissen, and Romijn (2001, in Asamoah, Antwi, Akyeampong, Baidoo, & Owusu-Koranteng, 2014), environmental management is a process in which establishments – both private as well as public – implement procedures to develop and effect prioritize activities that are based on defined objectives. Asamoah *et al* (2014) continue to argue that this is done to ensure the preservation and/or improvement of environmental quality, to provide environmentally-influenced goods and services, and to conserve, maintain and enhance the natural resources in which they operate. Asamoah *et al.* (2014) further references Kessler *et al.* (2001) noting that they argued that environmental management is therefore the total sum of the activities which are carried out by an organisation with the primary objective of protecting the environment which they do by attempting to control the negative impact that humans may have on the environment in order to preserve natural resources. They further posited that a key focus of environmental management is that of pollution reduction, and contended that companies develop environmental management plans (EMPs) to provide a framework for managing their environmental responsibilities, in particular to integrate them into the overall operations of companies (Asamoah *et al* 2014). Environmental management therefore enables an organisation to understand, describe and control its environmental impacts, reduce the risk of potentially costly pollution incidents, ensure compliance with statutory and regulatory requirements, and continually improve its business operations (Asamoah et al 2014). Ultimately, environmental management aims to reduce negative impacts on the environment by promoting efficient production practices (EMI 2009).

## 2.3 Background Development of ISO

Following is a discussion on the strategic decision to establish an international organization to development standards that will be recognised by organisations worldwide.

### 2.3.1 The International Experience

The examination below focuses on the establishment of the International Organization of Standardization (ISO), its strategic importance in international benchmarking in management systems for quality, products and the environment among others.

#### 2.3.1.1 International Organization of Standardization (ISO)

According to Aba and Badar (2015), the purpose of the International Organization of Standardization (ISO), which was created in Geneva, Switzerland, in 1947, is to produce globally accepted industrial and quality standards to ensure that quality assurance standards are formulated, implemented and maintained in the design, development, production, installation, and service fields in which organisations operate. ISO is a partnership of non-governmental organisations that have the common purpose of developing these international standards not only to enable the trading of goods and services, but also to advance collaboration and the exchange of ideas and technology between these regional and international entities and organisations (Conway, 1996). The main objective therefore is to foster the development of standardisation, facilitating the exchange of products and services between the trading partners. Currently, ISO has published more than 14,000 international standards (ISO standards) of which some are applicable to products and others for management standards (Arana, 2012).

According to ISO (2005), the International Organisation for Standardisation (ISO), which consists of a network of the National Standards Institutes of 151 countries, with one member per country and coordinated by a Central Secretariat in Geneva, Switzerland, is the world's leading initiator of standards. The ISO standards are a major factor in ensuring the effective development, processing and supply of safer and cleaner products, the efficient provision of professional services, and the easier rendering of fair trade between countries (Quality Network, 1996).

#### 2.3.1.2 The Purpose of Standards

Standards provide a foundation for companies to reduce the costs associated with information-related transactions, and are therefore important for promoting economic efficiency in organisations (Nadvi & Wältring, 2004). Gallant (2007) claimed that standards are beneficial for almost all varieties of establishments, including corporates, industries, governmental regulatory bodies, auditing and assessment professionals, trade officials, suppliers of products, customers, and professional service providers active in the public as well as the private sectors, as well as consumers and end users in the public. Standardisation, which is also sometimes referred to as harmonisation, can be generally defined as an activity that aims to apply a controlled approach to repetitive functions which occur in the industrial, scientific, technological and economic domains (Arana, 2012). Standardisation establishes an instrument of coordination and a mechanism of regulation that can be compared to other management tools such as economic markets, regulatory requirements, as well as the hierarchies of conventional organisations (Antonelli, 1994; Brunsson & Jacobsson, 2000). Therefore, according to Blind (2004), standardisation has been central to the growth and expansion of the international industrial society.

MSSes are standards that relate to the standardisation of a wide range of functions of business activities, inter alia ISO 9001 for QMS, ISO 14001 for EMS, OHSAS 18001 for OH&S, ISO 22000 for food safety and ISO 26000 & SA 8000 for corporate social responsibility. ISO 9001 forms the basis and influence of all the aforementioned standards, therefore all of them are inclined to have similar methods relating to their formation, operating processes, monitoring and measurement (Braun, 2005).

Arana (2012) confirmed that although it is a voluntary decision to implement this type of standard or norm, in certain segments the implementation of, and certification to, a management system constitutes an expected requirement. He continued further that the 'prescriptive' role is common amongst large corporate organisations in the automotive, construction, telecommunications and energy sectors. Such firms have identified in the ISO standards (QMS/EMS/OH&S) an opportunity to ensure that their service providers, suppliers and subcontractors maintain a certain level of quality, gaining the assurance that these companies are compliant with the formulated prescriptions of the larger companies without an increase in their operating costs (Arana, 2012).

#### 2.3.1.3 The ISO 9000 Standard

According to Wilson *et al.* (2003), the ISO 9000 range of codified, verifiable, and easily adaptable QMSes was published in 1987, which was subject to substantial reviews in both the 1994 and 2000 versions. The latest revision of ISO 9001 was published in 2015. As posited by Pantouvakis and Dimas (2010), the ISO 9000 series aids organisations to launch and implement their internal quality assurance management systems. Kartha (2004) noted that these are generic quality standards, and are therefore applicable not only to products and services, but to all internal processes. They are also flexible enough to be effectively implemented by organisations operating in both the service as well as the manufacturing industries. Thus, ISO 9000 standards assist firms with both internal progress as well as the strategic benefits which go hand-in-hand with the quality tools such as the setting of objectives, monitoring and measurement, management review and internal audits, Wilson *et al*. (2003) identified these internal improvements as those which are comprised all of the business activities that are associated with a product. ISO (2011a) contended that a firm which obtains ISO 9000 fulfils the quality requirements of their customers, and is also compliant with the applicable statutory and regulatory requirements. These parameters are in addition to improved customer satisfaction as well as achieving continual improvement in quality output. According to the ISO 2014 survey, 1,138,155 companies were certified worldwide to ISO 9001:2008 (ISO 2014).

#### 2.3.1.4 ISO 14001

The ISO 14000 family comprises the environmental management standards that were crafted in response to universal concern regarding the environment, as well as the success of ISO 9000 (Morris, 2004; Delmas & Montiel, 2008). Sayre (1996) confirmed that the ISO 14001 standard was derived from British Standard 7750, which included the requirement for EMS and was generally accepted as the international baseline for reliable and effective environmental performance. Scholarly research indicates that since the initial version of ISO 14001 was launched, there has been a continual growth in the number of ISO 14001-certified companies the world over (Bansal & Hunter, 2003; Balzarova & Catska 2008). ISO (2011a) indicated that those companies that have obtained ISO 14000 certification can provide evidence that they have minimised the harmful environmental effects caused by their activities, and that they have accomplished continual improvement of their overall environmental performance. In addition,

ISO (2011a) contended that there are similarities in the processes of ISO 9000 and ISO 14000, despite the two standards targeting distinctive management areas of an organisation. That is to say, the quality assurance of goods and services versus the possible impacts on the environment that the identified operational aspects may have.

A study conducted by Delmas and Montiel (2008) validated that the ISO 14001 standard complements the QMS. They maintain that ISO 14001 established a comparable system to manage the environmental impact of the processing operations, despite the fact that both these standards address different audiences. ISO 9001 aimed to improve the processes and facilitate the meeting of the quality objectives, while ISO 14001 targeted the enhancement of the environmental performance as well as the conformity to statutory and regulatory requirements. Therefore, according to Delmas and Montiel, the adoption of ISO 14001 by companies was promoted by the successful implementation of ISO 9001. According to Macdonald (2005), the ISO 14001 standard includes the specification for an EMS that is made up of 17 general requirements or clauses in five categories, which is based on Stewart and Deming's post World War 2 methodology of plan-do-check-act (PDCA), which was founded on the concept of continual improvement.

The ISO 14001:2004 standard was developed by ISO to provide guidance to businesses that wish to improve their environmental performance. The standard proposition is a framework to be used for the effective management of an environmental programme that commits to objectives that may result in improvements that are in excess of statutory and regulatory requirements (Edwards *et al.,* 1999). The authors further identified ISO 14001 as an element of the ISO 14000 series, which encompasses guidelines for the design of an effective EMS whose ultimate development was motivated by the General Agreement on Trade and Tariffs (GATT) that was published in 1996, and the 1992 Rio Agreement of the UN Conference.

The above initiative relating to ISO 14001 followed mainly because of the rapid worldwide acknowledgement and approval of ISO 9000. In addition to the global proliferation of environmental standards that necessitated the ISO to evaluate the need for environmental management standards that could meet international requirements.

- Sayre (1996) added that the effective implementation of ISO 14001 offers the following benefits:
- The protection of the environment from the possible detrimental effects of an organisation's services, products and activities;
- The protection of human health;
- Assisting with the improvement and maintenance of the environment;
- Meeting the environmental expectations of customers and clients;
- The maintenance of good relations with the surrounding community as well as the broader public; satisfying the criteria set by investors and therefore enhancing access to investment capital;
- The reduction of insurance costs; an enhanced corporate image;
- Improved control of costs; an improved market share;
- The successful fulfilment of the certification criteria of suppliers;
- The limiting of liabilities;
- The improved conservation of resources;
- The provision of effective development and transfer of technology;
- Bestowing assurance to stakeholders that the corporation's goals, objectives, aims, targets and policies were observed

Table 2.1 outlines the structure of the ISO 14001 standard per clause (ISO 14001:2004).

**Table 2.1 Structure of ISO 14001:2004**

| Clause | Statement |
|---|---|
| 4 | Environmental management system requirements |
| 4.1 | General requirements |
| 4.2 | Environmental policy |
| 4.3 | Planning |
| 4.3.1 | Environmental aspects |
| 4.3.2 | Legal and other requirements |
| 4.3.3 | Objectives, targets and programme(s) |
| 4.4 | Implementation and operation |
| 4.4.1 | Resources, roles, responsibility and authority |
| 4.4.2 | Competence, training and awareness |
| 4.4.3 | Communication |
| 4.4.4 | Documentation |
| 4.4.5 | Control of documents |
| 4.4.6 | Operational control |
| 4.4.7 | Emergency preparedness and response |
| 4.5 | Checking and monitoring |
| 4.5.1 | Monitoring and measurement |
| 4.5.2 | Evaluation of compliance |
| 4.5.3 | Nonconformity, corrective action and preventive action |
| 4.5.4 | Control of records |
| 4.5.5 | Internal audit |
| 4.6 | Management review |

### 2.3.1.5 Impact of ISO 14001

Sayre (1996:1) commented that ISO 14001 advocated for "sustainable development for each and every nation and sustainable development for each and every person". This means that a company that is committed to ISO 14001 ensures that their activities, products, and services are not harmful to humans or the world they inhabit. Sayre (1996) maintained that ISO 14001 also fosters the principles and practices that are relevant to sound environmental practices and performances, i.e. the effective allocation of resources, the identification of responsibilities and accountability, and regular evaluations to measure continual improvement.

Rondinelli and Vastag (2000) conducted a study on the value of ISO 14001 environmental management systems at Alcoa's Mt. Holly plant. They discovered that after the company had been certified to ISO 14001 for three years, the organisation's management team had recognised the following impacts: an improvement in the environmental awareness of employees and managers; an increase in operational efficiencies; and an improvement in the overall operational effectiveness of the organisation. The study further established that the training programmes that had been introduced had increased awareness amongst employees of the importance of the waste reduction initiatives that had been initiated throughout the plant.

As per Johnson (1997), the ISO 14001 EMS fashioned a distinct and inclusive management system that allows for the effective management of an organisation's environmental responsibilities. In addition, it reduces a firm's liabilities, controls costs, documents its commitment to good corporate governance, and promotes a firm's responsibility and concern for the community it serves as well as the public at large. Renzi and Cappelli (2000) made the point that ISO 14001 can create competitive advantages for businesses such as upgraded raw material feedstock as well as an improved supply chain management, which results in conformity to statutory and regulatory requirements in addition to an enhanced corporate image.

Morrison, Cushing, Day & Speir (2000) postulated that environmental management systems are additional instruments which assist with identifying cost saving opportunities as well as opportunities to mitigate the environmental risk which both management and investors may be concerned with. According to Howes, John & Minard (2006), a company that has been certified to an ISO standard will deliver valid environmental improvements that are achieved as a by-product of the effective management of the EMS, which requires a focused attention on raw material use and the management of process waste.

Tari, Molina-Azorín & Heras (2012) postulated that the benefits most identified by scholarly studies on ISO 14001 are process efficiency, environmental performance and organisational profitability. In addition, other studies, which analysed ISO 14001, have also named a number of concomitant benefits. Poksinska, Dahlgaard and Eklund (2003) noted the collective benefits of environmental improvements as internal, external and relational.

The internal benefits were identified in the processing performance improvements such as better productivity efficiencies, procedures that are more effective and bigger profits. The

external benefits were noted as an increasing market share, an improved corporate image, satisfied customers and product delivery times. The relational benefits were observed as an enhanced rapport with regulatory authorities as well as improved interactions with its neighbours – the communities around where the plants are situated and from where it draws its workers, Poksinska *et al. (*2003).

Academic studies by various researchers such as Hillary (2004), Zeng, Tian and Shi (2005), Link and Naveh (2006), Cañón and Garcés (2006), as well as Gavronski, Ferrer and Paiva (2008), reached similar conclusions. All identified and differentiated between external and internal benefits. The latter were split into numerous groups, i.e. financial benefits (cost savings as a result of using less material in processing, reductions in energy use and a reduction in process waste); organisational benefits (improved procedures, quality of training, quality of management, improved and safer working conditions, improved and up-to-date relevant environmental information resulting in encouragement of innovation, and compliance to legal requirements); and people benefits (better motivated employees with enhanced skills, improved internal company image, and improved communication and dialogue between the shop floor and management).

ISO (2004) noted that the ISO 14000 series made its appearance in 1992 at the Environmental Summit in Rio de Janeiro during the General Agreement on Trade and Tariffs (GATT) deliberations. It must be noted that whereas GATT focused on the need to lessen non-tariff trade barriers, the focus of the Rio Summit was conversely on the need to protect the global environmental (Quality Network, 1996). Ofori, Gang and Briffett (2002) commented that the development of ISO 14000 as an EMS was recognised as an expected and progressive adjunct to the ISO 9000 Quality Management Standard. Whereas ISO (2004) contended that subsequent to the rapid acceptance of ISO 9001, a steady growth in environmental standards was observed globally, which necessitated ISO assessing its responsibility to develop international environmental management standards so that this new need could be met.

Because of this, the Strategic Advisory Group on the Environment (SAGE) was established in 1992 with the intention of:

• endorsing a mutual strategy to environmental management which was similar to the approach to quality management;

• boosting the capability of establishments to accomplish and assess the advances made in environmental performance; and

• enabling trade and eliminating trade barriers (ISO, 2004).

As a result of the endorsement from SAGE, in 1992 ISO formed technical committee TC 207 to develop an environmental standard. The first plenary session was conducted on 1 June 1993, with the directive to establish environmental standards in five areas of EMSes, i.e. environmental auditing; environmental investigation; environmental performance evaluation; environmental labelling; and life cycle assessment. TC 207 was split into five sub committees in order for each to tackle a classification of the standard, and one other sub-committee had the task of dealing with the required terms and definitions. A supplementary work team subordinate to TC 207 was formed to handle the environmental aspects that were applicable to the product standards (Conway, 1996).

According to ISO (2015), the ISO 14000 series offered a structure for the growth of an EMS and an accompanying audit plan. ISO 14001 further stipulated a design for an EMS against which a company may be assessed and certified by an external third party. The other standards in the 14000 family were essentially guidelines which included the following:

• ISO 14004, which provided a guide on the development and application of an EMS.
• ISO 14013/5, which provided a review and assessment of material for the audit programme.
• ISO 14020, which focussed on environmental labelling.
• ISO 14030, which provided a guide on the setting of EMS performance targets and their monitoring.
• ISO 14040, which focussed on life cycle issues.
• ISO 14063, which concentrated on environmental communication;
• ISO 14064, 14065 and 14067, which were standards that were specific to the measurement, monitoring, reporting and verifying of greenhouse gas emissions.

Of the 14000 series of standards, ISO 14001 was the most familiar to industry, and it was the only standard against which it was possible to be assessed and certified by an external certification body (ISO, 2015). According to ISO (2014), a survey conducted by ISO, the

number of companies that had been certified to ISO 14001:2004 amounted to 324,148 globally.

## 2.4 Benefits and Purpose of ISO 14001

As suggested by Khanna and Anton (2002), an environmental management system (EMS) represents a mind-set change, where decisions are made with both environmental and production practices in mind. An EMS is a systemised structure for managing the significant environmental impacts of an organisation. According to Morrow and Rondinelli (2002), when an EMS is effectively implemented, companies are able to experience a range of associated benefits. One of these is cost savings because of the reduction in process waste, as well as the efficient managing of resources such as water, electricity, steam, fuels, compressed air and gas. In order to realise maximum effectiveness, it is suggested that an EMS should not be set up as a stand-alone system, but should rather be built into the existing management structure (EMI, 2009).

The adoption of an EMS can assist an organisation to:

- improve its environmental performance by effectively managing the negative impacts of its activities;
- increase resource efficiency by reducing waste and energy use;
- be compliant with the statutory and regulatory obligations pertaining to the environment;
- realise financial savings through efficient production processes as well as the effective use of its resources; and
- earn an enhanced reputation with its staff, clients and other stakeholders (EMI, 2009).

Morrow and Rondinelli (2002), posits that as the company demonstrates that it is managing its environmental risks effectively, their insurance premiums may decrease. Operational benefits also accrue, such as better production performances and efficiencies, which can include fewer work stoppages; the reuse, reduce and recycling of waste; enhanced staff responsibility; improved internal communication; and better staff morale (Ammenberg, Hjelm & Quotes (2002). External benefits such as an improved public perception of the organisation, which may result in an economic advantage, could also occur (Ammenberg, Hjelm & Quotes (2002). This may not only lead to increased sales, but the neighbouring community may also

experience that the organisation is dealing with its impacts such as noise, smell, dust, and vibration in a proactive manner. Finally, customers, trade partners, stakeholders, regulators and local authorities may also become more confident in the organisation's commitment to environmental management (Morrow & Rondinelli, 2002). As per Matouq (2000), certification to ISO 14001 also serves to verify that the organisation's EMS is independently assessed (at regular intervals), thereby demonstrating their commitment to environmental transparency and accountability. This leads to a good public image being cultivated, positively influencing share price and stakeholder confidence.

In a research project undertaken by Thakore, Lowe and Nicholls (2013) to assess the effect of EMS on the economic performance of a company certified to ISO 14001, the authors found a linear correlation between EMS certification and the environmental and financial benefits to an organisation. They ascribed this finding to increased compliance to statutory and regulatory requirements, minimisation of waste, improved relationships with customers, a reduction in the use of resources, increased work efficiency and the adoption of good management practice principles. Radonjič, Pisnik and Krajnc (2015), meanwhile, found that an EMS results in benefits such as process optimisation, the efficient usage of raw materials and energy, as well as a reduction in the creation of process waste and water consumption, all of which culminate in reduced operational costs. For these reasons, EMSes have become part of the integrated management systems of organisations, with the aim of minimising and effectively managing the negative environmental aspects that may be linked to the services, activities and products of an organisation (Perotto *et al.*, 2008; Campos & Melo, 2008).

## 2.5 Case studies – ISO 14001

Following are three scholarly case studies on the motives and benefits of implementation of ISO 14001 environmental management systems.

### 2.5.1 Study 1 – sources of motivation for ISO 14001 benefits

Heras-Saizarbitoria, Landin, & Molina-Azorin (2011) cite Bansal and Roth (2000), that when focussing on ISO 14001, the researchers draw a distinction between three types of motive that lead companies to implement ISO 14001, i.e. relational, ethical and competitive. They further advance that relational motives stem from a company's desire to show they are doing things in a legitimate manner and to enhance the interaction between the various stakeholders and and interest groups in the company. Ethical motives arise from the company's response to its feelings of environmental responsibility and the competitive motives emerge from the company's search for a competitive advantage. They further cite Neumayer and Perkins (2005) who, similarly, stress that, in broad terms, there are two main sources of motivation which lead organisations to implement ISO 14001. These are efficiency motives, which are linked to performance, productivity and profitability improvements, and, institutional or external motives that are connected to the social pressure, which is exerted by various, and different drivers to persuade organisations to embrace certain practices. The research found that companies that adopted ISO 14001 based on internal drivers experienced a higher level of satisfaction than those companies who responded to external drivers.

### 2.5.2 Study 2 - difficulties as well as the benefits derived in Greek companies

Evangelos (2011) conducted a research project in 53 ISO 14001-certified Greek companies to assess the motivations for implementing an environmental management system to the requirements of ISO 14001 in order to determine the difficulties in meeting the requirements of the standard as well as the benefits derived. The study found that internal motives were main driver for the decision of the companies to be ISO 14001-certified. The research further exposed the fact that the requirements of ISO 14001 and the determination of environmental performance issues were the extracted hidden constructs of the complications confronted during the implementation of ISO 14001. However, according to the research findings, the

intensity of these challenges was not high. The improvement of a company's market position, the conversion from orthodox to sustainable management practices, the enhanced relationship with its neighbouring community as well as society in general as a result of better environmental performance and the improvement in processing its waste products, were the extracted latent constructs of the benefits derived. The study found that even though they were not extremely high, the internal benefits were more significant than the external benefits (Evangelos *et al.,* 2011).

### 2.5.3 Study 3 – the motivations for Macao organizations to adopt ISO 14001

A study was conducted in Macao SAR, China by To and Tang (2014) to investigate the trend, motivations, and perceived benefits of the adoption of ISO 14001 using the data from the latest ISO Survey of Certifications. The study identified the growth pattern of ISO 14001 certifications in Macao SAR by nonlinear regression and examined the motivations for Macao's organizations to adopt ISO 14001 and the quantified the perceived benefits of implementing ISO 1400. They used a quantitative survey instrument and follow-up interviews with environmental management representatives of the identified sample companies. A trend analysis of the research data revealed that the implementation of ISO 14001 follows a logistic function. The survey results revealed that the principal motivating factors included fostering environmental awareness among employees, improved control of environmental regulatory compliance in addition to improved efficiency (To and Tang, 2014).

## 2.6 The South African Experience

Following is a discussion of the influence of ISO 14001 on South African businesses and the impact on the South African legislative framework.

### 2.6.1 Statutory and Regulatory Focus in South Africa

Although some environmental laws were in force before the promulgation of the South African Constitution in 1996, Chapter 2 of the Constitution firmly entrenched environmental protection as a human right. Section 24 not only grants to South African citizens the right to an environment which is not harmful, but also imposes on the state a constitutional duty to ensure

the environment is protected through the enactment of reasonable statutory and other regulatory requirements (van der Linde, 2006). Building on and supporting the Constitution is the National Environmental Management Act (NEMA) No 107 of 1998, which provides central legislative support for environmental control in South Africa.

NEMA (1998) defined the environment as: "…*the surroundings within which humans exist and that are made up of – i) the land, water and atmosphere of the earth; ii) micro-organisms, plant and animal life; iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being*".

Numerous sector-specific National Environmental Management Acts (SEMAs) have also been enacted (energy, air, water and waste). The core of NEMA is an array of principles that influence any environmental statute, the application of such statutes, as well as the crafting and execution of environmental management plans across all strata of government, be it local, provincial or national (Constitutional Assembly, 1996). Although all organisations in South Africa have to comply with the provisions of the legislation, it is only those companies that have ISO 14001 certification that are audited by certification bodies at regular intervals to assess whether their systems and processes are compliant with the statutory, regulatory and ISO 14001 requirements. Within this legislative context, certification to ISO 14001 is an option, however, as shown by scholarly studies, a commitment to succeed by the company, teamed with the assessment experience of the chosen accredited certification entity, may achieve significant benefits. Although compliance with the requirements of ISO 14001 is a voluntary decision by companies operating in South Africa, parliament has promulgated legislation in order to transfer the burden of proof with regards to sound environmental management onto individual organisations (SABS, 2013).

Regarding the South African context, the King III (2009) Report addressed sustainability in relation to the triple bottom-line notion, encompassing the 3 Ps of profit/financial, people/social responsibility and planet/environmental sustainability (Carroll & Buchholtz, 2000). Van Wyk and Deegan (2009) indicated that the principles espoused in the King III (2009) Report – although it is not legislation - are obligatory for businesses of all sizes - large and small.

### 2.6.2 The South African Business Focus

Finlay (2000) suggested that in South Africa, the exploitation and sustainability of the environment is an abiding concern. As argued by Lin and Ho (2008), the natural environment has become a crucial component within the changing competitive business landscape; therefore businesses have been developing and introducing novel and inventive initiatives in order to give themselves a global competitive advantage. In addition, businesses can improve their competitiveness by introducing enhancements into their environmental performance so that they are compliant with their legal obligations, focus on the environmental concerns of customers, and minimise the negative environmental impact that its products and service activities may have (Lin & Ho, 2008). In his research, Engel (2008) stressed that South African companies had seen significant progress in terms of environmental management over the previous decade by enacting legislation and implementing strategies that were focussed on green issues and sustainable development.

However, despite this, most companies still do not accept the importance of 'going green'. In the past, businesses presumed that integrating green practices into their business strategies would not be cost effective. However, companies have since come to the realisation that if they ignore the negative impacts that their activities have on the environment, there will be a future negative financial and economic impact (Van der Zee, 2008). As argued by Robinson (2008), the objective of the green industry is to employ process methodologies and use products that will not cause pollution or deplete natural resources. Dallas (2008) argued that if companies employ alternative sources of material to reduce the use of natural resources, it would have positive outcomes such as a reduction in waste generation, the reuse of materials, and the maintenance of a small environmental footprint. In addition, this strategy will result in the efficient and effective use of scarce natural resources, while simultaneously preventing the environment from being exposed to harmful products and waste (Smith & Perks, 2010). As espoused by Gunningham, Kagan and Thornton (2003), the goal of a green enterprise is that green visions must be realised, which require that their strategic initiatives should be premised on long-term objectives for short-term targets.

In 2006, Matela concluded that South African companies implemented ISO 14001 primarily to profit economically and because the international market demanded certification, and to a

lesser extent because of an improved environmental mind-set and behaviour. The benefits which accrued included enhanced awareness, reduced costs, more meaningful data collection and management, as well as improved corporate reputations with the public and government agencies. Because ISO 14001 has the potential to improve business success whilst simultaneously resulting in a more reasonable and responsible approach to environmental management, it can be used as a favourable instrument to achieve these goals for South African companies, which is in line with the literature of scholars such as Morrow and Rondinelli (2002) and Ofori *et al.* (2002). This underscores the advantages that ISO 14001 brings for both the environment as well as industry.

### 2.6.3 Requirements for EMS from the South African automobile industry

A key factor in this research project is the influence that the South African automotive industry has on its suppliers. As the majority of the selected sample companies are suppliers to the automotive manufacturers, its influence regarding EMS certification is substantial. Bulltek (2009) contended that the majority of automobile manufacturers (OEMs) have over recent years made their commitment to preserving the environment known by being certified to ISO 14001 themselves, and have subsequently requested – and in some cases forced - their 1$^{st}$ tier suppliers to be certified to ISO 14001 EMS. He added that OEMs have introduced on-going recycling projects internally, as well as programmes to search for initiatives that will increase the ratio of recycled materials and components in their vehicles. As these programmes are extended to their suppliers, they are in turn encouraged to investigate the use of both eco-effective and eco-friendly components for motor vehicles of the future.

#### 2.6.3.1 Ford Motor Corporation

The Ford Motor Company (2014) has saved millions of dollars since it became the first automobile manufacturer worldwide to have an EMS at all its manufacturing facilities certified to the ISO 14001 standard, which has resulted in ISO 14001 gaining significant exposure globally. This landmark achievement is seen to have set the benchmark for the future in the motor vehicle manufacturing industry.

The reasons why certification to ISO 14001 has become a pre-requisite for organisations wanting to do business with FMC include:

• Its truck facility in Michigan has seen a daily reduction of water usage of approximately one million gallons per day. In addition, 1,975 fluorescent globes in the plant were replaced with metal halide globes, resulting in further annual savings in electricity costs of $66,000 per annum.

• When FMC replaced their cardboard packaging material and plywood boxes with metal containers and reusable plastic, they realised a reduction in disposable packaging of 82 million kilograms (Fielding, 2000).

In South Africa, Ford's Silverton plant not only recycles and reuses the water consumed by the manufacturing plant, but is also realising an increasing ratio of recyclable components in its vehicles (Ford, 2014).

#### 2.6.3.2 General Motors

Within weeks of the Ford Motor Company's announcement regarding ISO certification, General Motors declared that they required all of their suppliers to be certified to ISO 14001 by 31 December 2002 (Fielding, 2000). General Motors South Africa (GMSA) issued the following statement: "As a responsible corporate citizen, General Motors South Africa (GMSA) is dedicated to protecting human health, natural resources and the local and global environment. This dedication reaches further than compliance with the law to encompass the integration of sound environmental practices into business decisions. It also extends to our suppliers, contractors and visitors to GMSA," (GMSA, 2009a; 2009b).

#### 2.6.3.3 Nissan

According to Thomaz (2009), Nissan South Africa's Rosslyn Plant has established a water-treatment facility to purify its industrial effluent water, which is tested and then safely returned to the surrounding environment. In addition to this, the company has developed a dam and wetlands area next to the Rosslyn plant into which they introduced fish, subsequent to which bird life has become abundant. The plant harvests rain and storm water and redirects it to the dam, which joins a local river.

#### 2.6.3.4 Durban Automotive Cluster (DAC)

In a report on a study conducted on 37 companies in the Durban Automotive Cluster (DAC) on the barriers they encountered during the implementation of ISO 14001, O'Neill (2007) commented that all the companies in the study that had been certified to ISO 14001 had also implemented other management systems such as ISO 9001. In addition, some had also been certified to ISO/TS 16949, which was a mandatory requirement of the original equipment manufacturers (OEM) in the automotive industry for all their first tier suppliers. The author further commented in agreement with Reiner (2011) that the results of the study indicated that implementing an EMS was directly related to other functional fields within the companies, which included QMS as well as Occupational Health and Safety and an engineering maintenance programme. The conclusions drawn from the empirical data were twofold, i.e. the foremost motivation for the implementation of ISO 14001 EMS was customer requirements and profit incentives, and the top management of the sample companies viewed certification to the requirements of ISO 14001 as a calculated pre-condition for sustainable success and viable long-term survival. In addition, the researcher noted that management required a paradigm shift in order to ensure that environmental management was included as a preference when planning their strategic initiatives (O'Neill, 2007).

### 2.6.4 Pretoria Portland Cement (PPC)

According to ISO (2011b), who credited Moodley, Pillay, Jandrell and Weissinger (2010) for a case study on the impact of ISO standards at Pretoria Portland Cement Company (PPC Cement) which indicated the following qualitative considerations:

- As a result of PPC's custom of implementing standards (ISO 9001, ISO 14001, OHSAS 18001, SANS/IEC 17025, SANS 50196, SANS 50197 and SANS 1841), the experiences of the company's contractors had been improved.
- ISO 14001 implementation had resulted in the reduced consumption of energy and an improved environmental record.
- Workforce competency levels were increased.
- Process waste, emissions and product defects were reduced.
- Production processes were streamlined.

- Production costs were reduced.
- The incidences which cause health and safety issues were reduced.
- There was an expansion of markets and success in new contracts.

According to the study, when considered together, the impact of the collective measures stated in the research report supported the positive reputation that PPC has earned with its clients (ISO, 2011). The researchers added that according to PPC company data, the standards contributed to these benefits due to the improved efficiencies in the manufacturing processes, which were realised as the applicable standards were primarily employed by the company's R&D unit to ensure that these processes were compatible with, and regularly upgraded to, new technology. The report further indicated that the introduction and application of standards had additional positive impacts on both staff development as a result of the reduction in the time required for training, as well as a reduction in the time required to finalise contracts with customers and suppliers. Finally, the study confirmed that the standards boosted the sales process, as the consistently reliable quality of the standardised products increased customer confidence (ISO 2011).

## 2.7 Why do organisations pursue certification to an EMS?

Vastag and Melnyk (2002) argued that some organisations pursue EMS certification so they can be considered an environmental leader in the industry, or alternatively, that certification to ISO 14001 may be a customer demand as a precondition for trading. Additionally, some organisations pursue ISO 14001 certification if it is financially justified and when the perceived benefits are seen to outweigh the perceived costs.

## 2.8 Conclusion

This chapter reported on the literature relating to the environmental management system based on ISO 14001. It provided an outline of the international experience related to the establishment of ISO, expanding on what standardisation entailed the history and development of ISO 9001, followed by the history and development as well as the characteristics and advantages of ISO 14001. In addition, it presented literature that discussed the effectiveness of

ISO 14001 as a tool that can lead to improved operational, economic and financial benefits for companies. These benefits result in a business advantage for companies, improving the bottom line as a consequence. The chapter also presented a brief overview of environmental legislation in South Africa, as well as the impact of an EMS implementation in ISO 14001 certified companies.

Chapter 3 follows, where the research design and the methodology that was utilised to accomplish the research objectives will be discussed.

# Chapter 3: Research Design and Methodology

## 3.1. Introduction

This chapter presents an overview of the research design and the methodology that was utilised in order to achieve the objectives of the research. Firstly, the chapter expounds on the research design and the instrument used in the research. The methodology employed in the research to collect data focusing on the research subject is then described, and ethics and ethical issues are discussed. Next, the research questions and the consistency matrix are explained and the techniques used to collect the research data are further briefly described, with more in-depth explanations given as to how the data analysis was conducted. The chapter then looks at reliability and validity issues, before discussing the research limitations.

## 3.2. Research design

De Vaus (2001) postulated that the primary aim of research design is to ensure that the data obtained from research gives the researcher the tools to address the research problem effectively, logically and without any ambiguity. Creswell (2006) proposed that a mixed method research might work more effectively in obtaining relevant information, because both quantitative as well as qualitative research can answer different research questions. Creswell further cited Bryman (2006), commenting that both strands (quantitative and qualitative) pose questions and record the response data, which is then analysed and interpreted. Finally, both strands of analysed information combine to provide a framework for an effective overall interpretation of the data (Creswell, 2015).

### 3.2.1 Mixed methods

#### 3.2.1.1 Qualitative research

The goal of qualitative research is to obtain a profound perception of the circumstances; to probe more extensively into the subject's interpretations, motives and considerations in order to understand the varied meanings that subjects may experience (Cooper & Schindler, 2008).

#### 3.2.1.2 Quantitative research

Quantitative research aims to find accurate measurements of that which is studied. The data gathered from a quantitative study may, for example, consist of implied responses from the participants, or quantities which may have either reduced or increased and which may be analysed using statistical methods (Cooper & Schindler 2008).

In view of the fact that both quantitative as well as qualitative data were collected for this study, the researcher adopted a mixed method research design where data were collected in two stages. Stage One represented the quantitative method and involved the use of a questionnaire (which included both closed and open-ended questions), which was distributed primarily electronically via email to the selected participants. Stage One was thus characterised by the collection of quantitative data, which was considered a reliable method due to quantitative data being easier to measure and less speculative. In Stage Two, a representative sample (60% to 70%) of the respondents were approached via telephone and email for one-on-one in-depth interviews, in order to understand the internal challenges more fully and to allow a comprehensive analysis of the concerns which had been highlighted. As suggested by Swift and Piff (2005) and Walliman (2006), qualitative data analysis allows the researcher to make use of information toward making sensible decisions, and therefore informed the decision to undertake Stage Two. All interviews were conducted with selected personnel who were involved in the implementation and management of the EMS in their respective companies.

## 3.3. Methodology

Data were collected using structured questionnaires as well as in-depth interviews. Survey questionnaires dispatched via electronic mail were adopted due to its suitability, as it made data processing and analysis easy and cost effective. This research project adopted the electronic survey questionnaire instrument to obtain the data because: (i) the sample population was geographically dispersed; and (ii) it allowed the respondents a comfortable timeframe in which to respond to the questionnaires (Hussey and Hussey, 1997).

### 3.3.1 Survey research

According to Leedy and Ormrod (2004), the concept of survey research pertains to the process of eliciting information from people about their characteristics, attitudes, opinions, and previous experiences by asking pertinent questions, organising the received responses and drawing conclusions from them. Survey research therefore normally involves either requesting the completion of a written questionnaire or conducting either a face-to face interview or a telephone interview (Fowler 2002).

### 3.3.2 Questionnaire design

The questionnaire was formulated with the purpose of identifying and assessing the economic benefits to various organisations in different manufacturing sectors that have been certified to ISO 14001(EMS). Its focus was to quantify the financial improvements such as cost savings which had been realised with the effective implementation of ISO 14001. This resulted from the procurement of environmentally friendlier raw materials; the minimisation of waste from improved production processes; a reduction in the use of energy (electricity, steam, gas, fuels, compressed air) and water; the reuse of process by-products; and the recycling of waste associated with the adoption and implementation of ISO 14001.

According to Leedy and Ormrod (2004), although questionnaires may seem simple, they can be difficult to create and manage; a hasty questionnaire construction may lead to the provision of data, which is difficult to interpret, or may result in a very low response rate. The authors further suggested that the following guidelines be taken into consideration when a mailed questionnaire is submitted:

• Reflect on the timing: for some the middle of the month may be the most convenient time.
• Avoid vacation times or peak holiday times.
• Provide a cogent introduction to ensure a good first impression.
• Motivate your research by providing respondents with a valid reason to want to respond, such as making them feel that the research results will enhance the body of knowledge.
• Be polite, thank the respondents for their co-operation, and support (Leedy & Ormond, 2004).

The researcher is an experienced auditor and was familiar with the above suggestions, which were utilised during the data collection process as can be seen from the research invitation, the introduction letter, as well as the questionnaire (see Appendix 3.2) itself.

The questionnaire survey, which comprised both close-ended as well as open-ended questions, consisted of a total of 33 questions which were divided into five sections from section A to section E. Section A, comprising of Questions 1 – 6, required the respondents to provide broad information about themselves and the company's background. In section B, with Questions 7 – 14, the implementation of the environmental management system was explored. Section C, made up of Questions 15 – 25, gathered details regarding the advantages of implementing the EMS by quantifying the financial benefits of the various strategies, such as cost savings and waste reduction as well as awareness (20 – 24). Section D, incorporating Questions 26-28, explored the barriers (real or perceived) which the implementation of the EMS presented for the organisation. Finally, section E, comprising Questions 29 – 33, looked at obtaining data relevant to compliance issues.

The participants were invited to provide information regarding their own designations and their companies (Massoud, Fayad, Kamleh, & El-Fade, 2010) in order to ensure that the responses' reliability could be effectively assessed. The focus was to explore the experiences of the organisations with regards to the economic benefits they enjoyed thanks to the implementation of an EMS (Christini, Fetsko & Hendrickson, 2004).

A survey feedback response goal of at least 20 was set for the structured questionnaire. The sampling was done in 20 manufacturing companies across three metropolitan areas in the Eastern Cape Province, namely Nelson Mandela Metropolitan Municipality, which includes Port Elizabeth and Uitenhage, as well as Buffalo City Municipality, which includes East London and the Kwa-Zulu Natal Province the eThekwini Municipality that includes Durban and surrounding areas. The selected companies had fully implemented an EMS and had been certified to the requirements of ISO 14001 by accredited certification bodies such as the South African Bureau of Standards (SABS) and others. The key informants for the study were employees at management and supervisory levels of the certified companies in the manufacturing industry. This target population was individuals who were directly involved in the EMS implementation process and management within these organisations. Due to the

relatively small number of companies and the people working in them who were involved in ISO 14001, the sample was small and purposeful. Thus, it was a non-probability sampling strategy, utilising snowball techniques and convenient sampling where necessary. The companies and persons listed in Appendix 3.4 were contacted first telephonically and then by email.

The primary data were obtained through a structured questionnaire that was followed by in-depth interviews. The qualitative strategy was executed through the conducting of one-on-one interviews. The information gathered during the interviews was used to complement and further verify the results obtained from the questionnaires. Thereafter, a representative sample of 10 of the key informants who had responded were approached for additional, in-depth, one-on-one interviews, which were conducted in order to develop a better understanding of the issues and to enable deeper analysis of the issues at stake.

## 3.4 Structured interviews

According to Jamshed (2014), a structured interview - which is also called a standardized interview or a researcher-administered survey – is a quantitative research method commonly employed in survey research and the aim of the of this approach is to ensure that each interviewee is presented with exactly the same questions in the same order.

### 3.4.1 Face-to-face interviews

As posited by Marsiglio (2013), during the interview the researcher seeks qualitative knowledge or information that is expressed in regular, normal language and does not aim to quantify most responses. Trochim's (2006) view was that a face-to-face interview, which is the common name for a personal interview, is the most traditional method and generally lasts from 30 minutes to an hour. During the process there is direct transfer of information between the interviewer and the person being interviewed (Berry 1999). Some disadvantages of a face-to-face interview include that:

• it is time-consuming;
• it is resource-intensive;
• asking personal questions without embarrassing the respondent may be difficult;

• the training and experience of the interviewer is crucial; and
• the costs associated are high, particularly when travelling has to be undertaken (Trochim, 2006).

As suggested by Patton (1987), in-depth interviewing, which is also termed unstructured interviewing, is used to extract information that allows the interviewer to gain a general impression of the point-of-view of the interviewee. It involves asking unrestricted questions and sanctions the researcher to probe deeper if necessary for more useful information (Zhang 2000). In-depth interviewing involves qualitative data and is, therefore, called qualitative interviewing. Patton (1987) proposed three approaches when conducting this type of interview: (a) the standardised open-ended interview; (b) the guided interview approach and (c) The informal conversational interview.

For this research, the structured interview approach was selected so that the interviewer could stay on course to cover all the questions relating to specific topics, while in-depth probing could also be used. That is, prepared checklist/questions in order to ensure that all topics are covered during the interview were used. Despite this, the interviewer is still at liberty to ask and explore the questions which he/she may deem interesting or if he/she wishes to elicit more information regarding specific topics (Wenden, 1982). This broad interview approach is beneficial as it permits in-depth investigation while still allowing the interviewer to control the interview inside the boundaries outlined by the aim of the research. Semi-structured interviews are a method used in social sciences, which allows the interviewees a chance to express themselves, while structured interviews have a closed form that allows no diversity in the answers. This qualitative approach gives deeper insight into the matter at hand and makes it possible to answer the research questions more accurately (Bell, 2006). Although the interviews were guided by pre-prepared questions as shown in Appendix 3.1, the questions were open-ended which encouraged the respondents to offer a lot of information, including that which could have been overlooked otherwise.

## 3.5. Ethics and ethical issues

The researcher committed to treat all the research subjects in a respectful and ethical manner. Although the information gathered from the research was not of a sensitive nature, confidentiality was still maintained so as not to violate the rights of any individual or organisation. In all cases, the interviewees were informed prior to their interviews that the questioning was part of a graduate research project, that the feedback from the company responses would be kept confidential, and that there would be no direct reference to any company in the research paper, with only generic references mentioned. Consent forms were provided and no questions were asked until consent was received.

The researcher obtained ethical clearance from the University of South Africa to conduct the research, with the ethics code: 2015/CAES/115. The ethics clearance letter is attached as Appendix 3.5.

## 3.6. Research questions and the consistency matrix

To reach the objective of determining improved economic and financial benefits, the following research questions were asked:

Research Question 1: What drove the observed companies to implement an ISO 14001 EMS?

The data gathered to answer this research question came from 10 – 17 in the survey form (see Appendix 3.3).

Research Question 2: Did the implementation of an EMS improve process efficiency?

The questions in the survey form (see Appendix 3.3) which related to this research question were Questions 18 – 25.

Research question 3: Did the implementation of an EMS improve environmental awareness within the companies under study?

Questions 20 – 24 in the survey (see Appendix 3.3) formed the basis for the data to answer this research question.

Research question 4: Did the implementation of an EMS have financial benefits?

Questions 18, 19, 24 and 25 in the survey (see Appendix 3.3) spoke directly to this research question.

The following in-depth interview questions were focused on the main objectives of the research, which were to quantify the financial benefits of implementing an EMS:

1) Has the EMS resulted in an overall reduction of process waste? If yes, by how much?
2) Are you re-using waste in your process? If yes, how much?
3) Are you recycling waste? If yes, how much?
4) Has your waste to landfill decreased? If yes, by how much?
5) Have you changed to more environmentally-friendly raw materials? If yes, was there a cost reduction?
6) Are you using less electricity in your production processes? If yes, how much?
7) Are you using less steam in your production processes? If yes, how much?
8) Are you using less compressed air in your production processes? If yes, how much?
9) Are you using less water in your processes? If yes, how much?
10) Has the productivity improved? If yes, how much?

All of the above research questions were adequately and comprehensively covered in the survey questionnaire with information gathering questions, i.e. category, multiple choice and open-ended questions. In addition, follow-up interviews were conducted with a select sample of respondents in order to elicit further information to confirm the results of the survey questionnaire.

## 3.7. Data collection

A brief description of the two research instruments used is now given:

### 3.7.1 The questionnaire survey

In all cases, the interviewees were informed prior to the interviews that the questioning was part of a research project. At the outset, it was indicated to the respondents that the feedback from the company responses would be kept confidential and that there would be no direct reference to any company in the research paper, with only generic references mentioned. Consent forms (see Appendix 3.2) were provided and no questions were asked until consent was received. All the survey questionnaires (see Appendix 3.3), as well as an accompanying cover letter (see Appendix 3.1), were submitted to the respondents via email, who were requested to return them completed to the researcher by a pre-determined date. The comprehensive questionnaire was based on information obtained from the literature review. The 20 questionnaires, with the covering letter, were emailed to companies that were certified to ISO 14001 by the SABS and other certification bodies. The aforementioned was preceded by a telephone call to confirm with the selected respondents that a survey questionnaire would be forwarded to them and to request their collaboration. A reminder telephone call was made to all those respondents who did not return the questionnaire within a few days subsequent to the deadline for the return of the questionnaires. The results from this were generally very good, which may be explained by the fact that the researcher has or has had a good working relationship with all of the chosen individuals listed in Appendix 3.4. Some people did not get the emails sent to them, while some people claimed to have sent back responses which did not reach the author's email address given to them. Where there was a lack of common understanding regarding the answers provided to the survey questions, telephonic follow-ups were conducted. Eventually 16 responses were obtained from this survey; four invitees did not respond despite numerous follow-ups. The survey questionnaire which was sent to the selected individuals in the companies is attached as Appendix 3.3.

### 3.7.2 The structured interviews

The interviews were conducted in order to gain additional insights into the companies' environmental management systems. The aim was to give the research an additional descriptive interpretation about what the managers are coping with regarding the process of the implementation in their company.

For this research project, personal interviews lasting approximately one hour each were conducted. The sampled interviewees were individuals who were directly involved in the EMS implementation process and management within their organisations. This was a good representation because the individuals were all actively involved in the management of the EMS in each of their respective companies in the various manufacturing sectors.

The 10 interviewees were all acquainted with the researcher as he was an auditor with the SABS and audited the companies regarding the requirements of ISO 14001. In addition to detailed written notes, electronic recordings were also made during the interviews. The recorded notes were reviewed and recorded in electronic format immediately after the interviews. Where any uncertainty regarding the interviewees' responses was observed, the researcher developed follow-up questions and the respondents were contacted to clarify their responses.

## 3.8. Data analysis

The responses obtained from the completed questionnaires were collated, statistically analysed and graphically represented. Inferences were drawn from the statistics, conclusions were provided and then recommendations were developed. The collected data were captured electronically in a database to ensure effective handling and presentation. Microsoft Excel and Microsoft Word were the computer software programs utilised to organise the data and to present it in an easy to read and visually attractive format. During the interviews, the responses from the interviewees were primarily recorded in writing. In addition, in order to confirm the train of thought as well as to remove any misunderstandings which may have occurred, voice recordings of responses were made. Where constraints with understanding or

interpretation of the information were experienced, the SPSS statistics programme was employed to facilitate uncovering information which may have been hidden in the responses.

### 3.9. Reliability and validity

According to Phelan & Wren (2005), "*Reliability is the degree to which an assessment tool produces stable and consistent results*". He added "Validity refers to how well a test measures what it is purported to measure". Foster (2007) argued that reliability and validity are different but interrelated issues of survey development. The researcher must strive to formulate both the open-ended as well as the closed questions, in such a manner that the data obtained from the responses can be presented and analysed so as to render it both reliable as well as valid. In order to help ensure content validity, it is prudent to elicit the help of external "experts" to review and validate the instrument. The close-ended questions in the survey provided a good basis for data analysis, while the open-ended questions allowed the respondents to comment in an extemporaneous atmosphere as well as from their own experiences. The open-ended questions were analysed using Pareto charts of the various categories of responses. In addition, according to Yin (2013), the validity and reliability of data is increased by multiple sources of collection of information. For this study, the collection of the information was managed through the review of literature of academic research, as well as through structured questionnaires and in-depth interviews.

### 3.10. Limitations

Due to the relatively small number of companies and people working in them who were involved in ISO 14001, the sample was small and purposeful. The results of the study were: 13 responses from the questionnaire and 10 interviews. Interviews were conducted with selected personnel who were involved in the implementation and management of the EMS. Thus, the results are not generalizable across all manufacturing sectors in South Africa.

The majority of the companies (9/13) covered during the research were either owned by international companies or had partnerships with international companies, so their views may have been influenced by international perspectives or opinions.

## 3.11. Conclusion

This chapter presented an introduction, as well as an overview of the research design and the methodology that was utilised in order to achieve the objectives of the research. It was important that the reader be given a clear picture of how the researcher went about conducting the study, which techniques and approaches he implemented, and how he determined which sample to select. It expounded on the research design and the instrument used in the research, and described the methodology employed in the research to collect data focusing on the consistency matrix. In addition, the techniques used to collect the research data and how the data analysis was conducted were described. It further looked at the confirmation of the reliability and validity of the research data, and concluded with how the research limitations were discussed. Chapter 4 follows, where the email survey results are presented, analyzed, and discussed.

# CHAPTER 4: Findings and Discussion of the Survey

## 4.1 Introduction

Subsequent to the presentation of the research methodology in Chapter 3, the analysis of the survey results is now presented. The chapter is divided into five key segments: (A) Background information about the respondent companies and key personnel; (B) The environmental management system (EMS) implementation; (C) The advantages of implementing ISO 14001 EMS; (D) The barriers encountered with the implementation of ISO 14001; and (E) Compliance issues related to implementation of the EMS. The final section is a summary of the discussion of the results which concludes the chapter.

## 4.2 Analysis of survey results

Of the 13 companies that responded to the survey, nine (69%) were located in Port Elizabeth and Uitenhage (NMBM), one (8%) in East London (BCM), one (8%) in George and two (15%) in Durban (see Figure 4.1). The sizes of the organisations by virtue of number of employees ranged from 87 people to 1,800 people, with an average of 499 employees. In evaluating the economic clusters in which the respondent companies operate, eight respondents (61%) were from the Automotive industry, three (23%) were in the Rubber and Plastics industry, two (15%) were in Chemicals, and one (8%) was from the Food industry. A description of the operational activities per industry type is summarised in Tables 4.1 and 4.2.

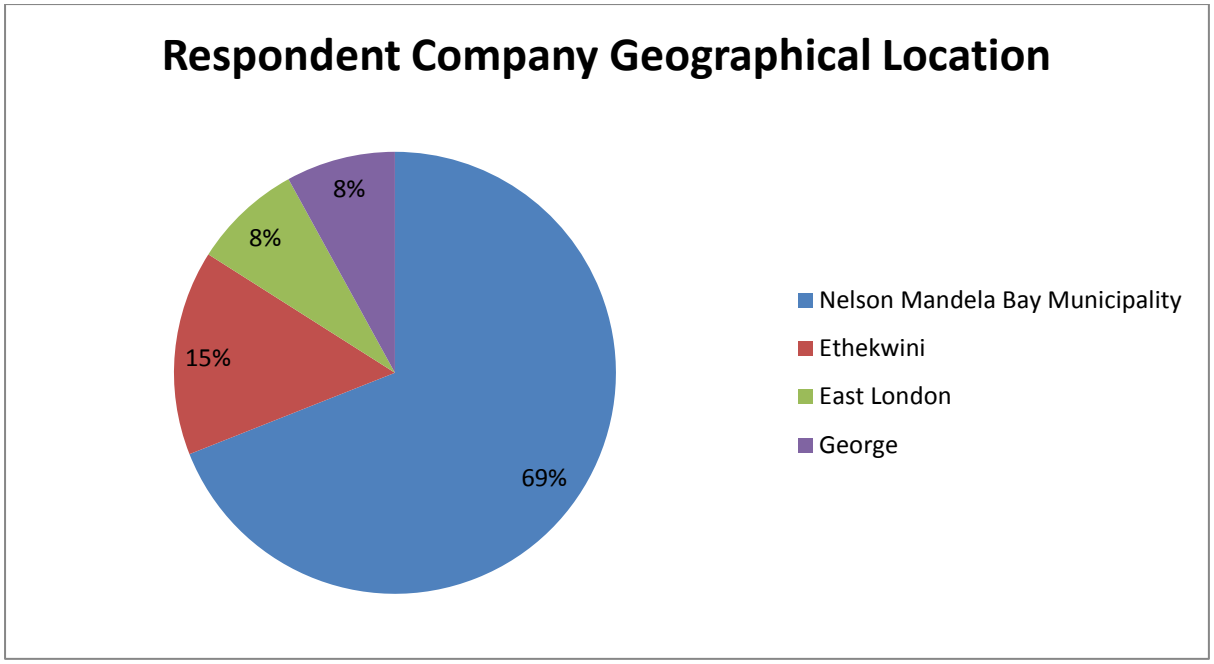


**Figure 4.1: Locations of the various companies that participated in the survey**

Table 4.1 provides information concerning company geographic location, the industry sector in which it operates, its size in terms of number of employees, the annual cost savings realised, the estimated cost of managing the EMS, the initial cost of implementing the EMS, and finally, the years of experience of the manager responsible for the EMS.

**Table 4.1: Details of respondent companies**

| Company Name | Geographical Location | Industry Sector | Company size (empl) | Cost saving p.a. | Est cost of EMS p.a. | Est cost of EMS implementation | Mgr Exp (yrs) |
|---|---|---|---|---|---|---|---|
| **Toyota Boshoku** | Durban | Auto | 891 | R 3 385 915 | R 75 000 | R 95 000 | 8 |
| **Shatterprufe Struandale** | NMBM | Auto | 315 | R 2 781 000 | R 70 000 | R 90 000 | 13 |
| **Shatterprufe Neave** | NMBM | Auto | 605 | R 2 780 791 | R 70 000 | R 110 000 | 8 |
| **Linde & Wiemann** | NMBM | Auto | 191 | R 1 250 000 | R 80 000 | R 95 000 | 9 |
| **Cataler** | Durban | Auto | 87 | R 395 349 | R 80 000 | R 100 000 | 6 |
| **Contitech** | NMBM | Rubber & Plastic | 170 | R 330 000 | R 70 000 | R 80 000 | 12 |
| **Dana Spicer Axle** | NMBM | Auto | 365 | R 240 000 | R 70 000 | R 125 000 | 9 |
| **Floorworx** | East London | Rubber & Plastic | 135 | R 220 000 | R 70 000 | R 85 000 | 5 |
| **Eveready** | NMBM | Chemical | 228 | R 200 000 | R 75 000 | R 85 000 | 5 |
| **GMSA** | NMBM | Auto | 1200 | R 200 000 | R 70 000 | R 85 000 | 20 |
| **Coca Cola Fortune** | NMBM | Food | 1800 | R 365 000 | R 75 000 | R 140 000 | 6 |
| **Data Dot Technologies** | George | Chemical | 130 | R 60 000 | R 45 000 | R 100 000 | 2 |
| **Bridgestone** | NMBM | Rubber & Plastic | 369 | R 60 000 | R 75 000 | R 90 000 | 10 |
| **Average** | | | | R 943 697 | R 71 154 | R 98 462 | 9 |

**Table 4.2: Industry clusters of respondent companies**

| Industry type | Description of operations involved | Responses |
|---|---|---|
| **Rubber & Plastics** | • manufacture of tyres<br>• manufacture of rubber conveyor belts<br>• manufacture of vinyl floor tiles | 1<br>1<br>1 |
| **Automotive** | • manufacture of automotive glass<br>• manufacture of automotive seats<br>• manufacture of automotive axles & diffs<br>• manufacture of catalytic convertors<br>• assembly of motor vehicles | 2<br>2<br>1<br>1<br>1 |
| **Chemical** | • manufacture of chemicals<br>• manufacture of automotive identification dots<br>• manufacture of battery cells | 2<br>1<br>1 |
| **Food** | • manufacture of beverages | 1 |

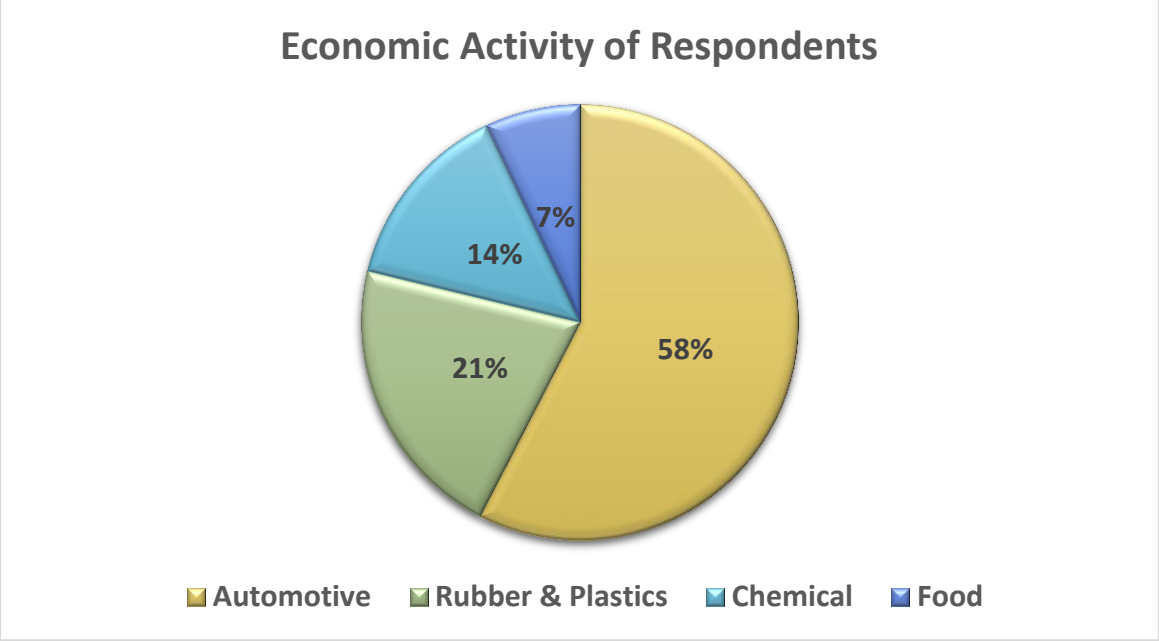


**Figure 4.2: Economic clusters of the participating companies**

## 4.3 Respondents' Individual Profiles

From Section A (Questions 1-6) of the survey questionnaire, personal information of the respondents were obtained. The selected respondents were all middle to senior management staff, who were responsible for managing the environmental management system of the organisations they represented.

All the respondents had received training on the requirements of ISO 14001: 12 of the 13 respondents - 92% - had acquired a tertiary qualification, while 4 out of 13 respondents - 29% - had a tertiary qualification in the field of Environmental Health. The work experience in EMS of the respondents ranged from 2 years to 20 years, with an average of 8.7 years. The respondents' positions and the companies they represented, is shown in Table 4.3 below.

**Table 4.3: Job profiles of respondents**

| Company | Portfolio |
|---|---|
| **Bridgestone** | SHEQ Manager |
| **Coca Cola** | SHEQ Manager |
| **Dana Spicer Axle** | Eng. Manager |
| **Data Dot Technologies** | Senior Manager |
| **Eveready** | Eng. Manager |
| **Cataler** | SHE Manager |
| **Floorworx Africa** | Systems Manager |
| **Ind. Oleochem. Products** | SHEQ Manager |
| **Linde & Wiemann** | HSE Manager |
| **Shatterprufe Neave** | SHE Manager |
| **Shatterprufe Struandale** | SHE Manager |
| **Toyota Boshoku** | SHE Manager |
| **Veyance Technologies** | Plant Engineer |

## 4.4 ISO 14001 EMS Implementation

All the respondents said that they had implemented ISO 14001 as the EMS, and the South African Bureau of Standards (SABS) had certified all to the requirements of ISO 14001. The respondents were asked to describe their motivations for implementing ISO 14001 EMS, and the responses were listed as either a corporate requirement (54%) or a customer requirement (46%). Twenty three percent of the respondents had employed the services of a consultant to assist them with the implementation of the ISO 14001 EMS, while 77% had implemented the EMS without external support. All the respondents were of the opinion that the implementation of the EMS had been successful. In addition, most said the SHEQ Manager / SHEQ department was responsible for the implementation of the EMS. In terms of who drove ISO 14001 implementation in the organisation, 62% were of the opinion that top management was the main driver, while 30% thought it was the employees and 8% concluded that their customers were the main driver.

## 4.5 Reasons for the successful implementation of ISO 14001

All (100%) the respondents were convinced that their implementation of the ISO 14001 EMS were successful because they could build on the experience that their companies had gained with respect to managing other management systems, such as the ISO 9001 quality management system. They also felt that they had been successfully implemented due to strong management commitment and involvement, as could be seen by the attendance of the management team at communication sessions on the factory floor, as well as during process improvement brainstorming sessions. Other factors reported were the effective training of employees (30% indicated this) and employee involvement (23% indicated this).

## 4.6 Cost savings achieved due to the implementation of ISO 14001

Open-ended questions were posed in order to quantify the monetary value of the cost savings realised due to the implementation of ISO 1400.

As graphically presented in Figure 4.3 below, the range of responses were as follows:

a. 61% noted that a **decrease in pollution** during the production process had been achieved, which resulted in a reduction or elimination of remedial costs.

b. 84% were convinced that a **reduction in waste** had been realised, resulting in lower waste transport costs as well as reduced levies at the landfill sites.
c. 54% said the re-using of process waste was now in place, resulting in a **reduction in the use of virgin raw materials**.
d. 92% said there was now **recycling of waste, which created a new income stream** as the process waste material is now sold as a by-product.
e. 38% felt that there had been **cost savings** due to more efficient production processes, a reduction in process waste, improved energy utilisation and the re-use of process water.

Not a single respondent thought that the company had managed to increase its market share because of the adoption of this EMS. They said production volumes had not increased since implementation, nor had there been an increase in orders. However, they did confirm that the company had maintained its order book as a result of the implementation of the ISO 14001 EMS, i.e. it assisted them with the retention of customers. Each respondent felt that the overall financial impact was positive, and all of them selected more than one of the suggested indicators. Everyone presented estimated and/or calculated figures for the monetary impact that the implementation of ISO 14001 EMS had realised for the company.

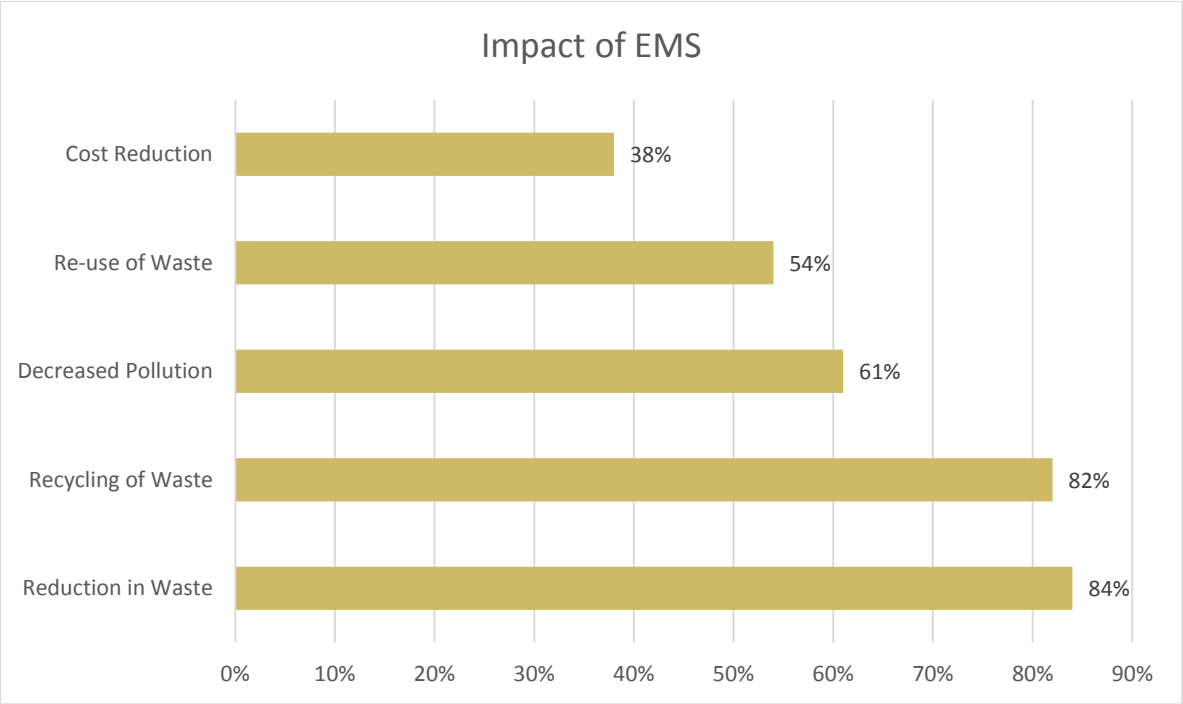


**Figure 4.3: Impact of ISO 14001**

### 4.7 Value of cost savings achieved due to the implementation of ISO 14001

**Table 4.4: The quantified values per annum of the responses**

| No | Cost-saving factor | Value p.a. (Rand / k) Range of responses | Average value p.a. (R / k) |
|---|---|---|---|
| **1** | Decreased pollution at production processes | R 554k; R110k; R 79k; R 10k. | R 188 k |
| **2** | Reduction in waste generated | R 2 400k; R 2 400k; R 497k; R 450; R 192k; R 90k; R 79k; R 50k; | R 770 k |
| **3** | Re-use of waste | R 380k; R 80k; R 79k; R 60k; R 35k; R 19k | R 108 k |
| **4** | Recycling of waste | R 1 733k; R 173k; R 150k; R 80k; R 79k; R 60k; R 20k | R 327 k |
| **5** | Increased productivity | Not able to say | |
| **6** | Reduction in processing cost | R 1 094k; R 180k; R 79k; | R 451 k |
| **7** | Increased market share | Not able to say | No response |
| **8** | Total financial benefit p.a. | R 3 386k; R 2 800k; R 2 781k; R 1 250; R 395k; R 365k; R 330; R 240k; R 220k; R 200k; R 200k; R 60k; R 60k | R 943 k |

All the respondents were of the opinion that the implementation of ISO 14001 had resulted in improved overall management with annual financial benefits realised. The responses indicated that the initial estimated annual cost of implementing the EMS ranged from R80 000 to R140 000, with an average of R98 000.

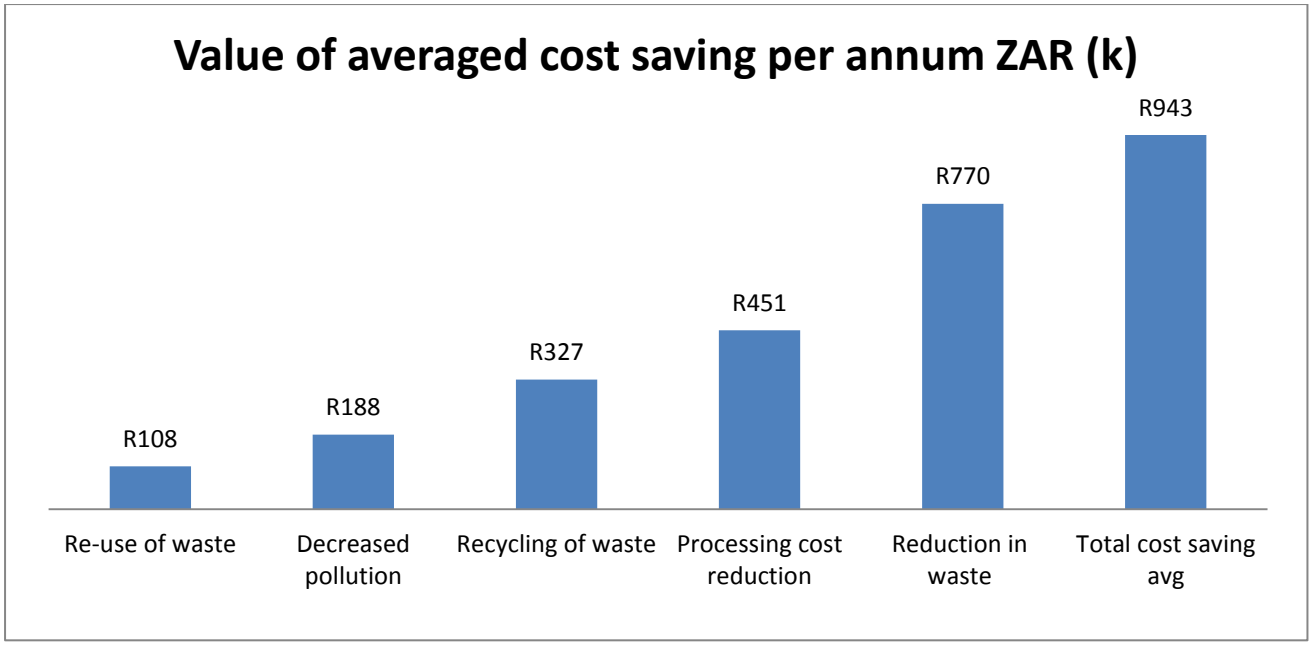


**Figure 4.4: Value of averaged cost savings achieved due to implementing ISO 14001**

## 4.8 Perceptions of changes due to the implementation of ISO 14001

Almost all (92%) of the respondents agreed that the attitude of their employees with respect to environmental awareness had changed since the implementation of ISO 14001, and 85% noted that the implementation of ISO 14001 had resulted in continued orders for the company. Five out of thirteen respondents (38%), indicated that there was a substantial improvement in the overall EMS awareness of employees in their organisation, while seven out of thirteen respondents (54%), indicated that there was some change in the overall EMS awareness of employees in their organisation. One response (8%) noted that there was no change in the overall EMS awareness of the organisation after the implementation of ISO 14001.

**Table 4.5: Perceived changes due to implementation of ISO 14001**

| Perceived changes due to EMS | Frequency of response | % |
|---|---|---|
| **Increased EMS awareness** | 13 | 100 |
| **Increased orders** | 11 | 85 |
| **Improved overall management of processes with increased financial benefits** | 13 | 100 |

## 4.9 Barriers experienced to implementing ISO 14001

The respondents indicated that the main barriers encountered to the successful implementation of ISO 14001 were:

a. high monetary investment (more than R80k) was required (62%); and
b. ignorance of regulations or legal requirements (38%).

In terms of obtaining ISO 14001 certification, 69% indicated that lack of support from management was the main problem, in that it was left to the SHEQ department to manage the process. Some 84% of respondents felt that maintaining an ISO 1400 EMS was expensive. The responses indicated that the estimated annual cost of maintaining the EMS (certification, training sessions, awareness, information; legal updates; consultants) ranged from R 45 000 to R 80 000, with an average estimated cost of R 71 000 per year.

## 4.10 Compliance Issues

When considering compliance issues, 92% of respondents were of the opinion that their organisation regarded environmental compliance as important in its operations, with 84% believing that their company's activities had a significant impact on the environment. Some 69% of respondents were of the opinion that their environmental impacts were positive, while 16% believed the impacts of their organisation's activities were negative and a further 15% did not know. All the respondents conduct regular internal audits which include legal compliance to assess the effectiveness of the EMS, and all were confident that their EMS

contributes to their organisations' functioning within the statutory, regulatory and other requirements as entailed in clause 3.2 of ISO 14001.

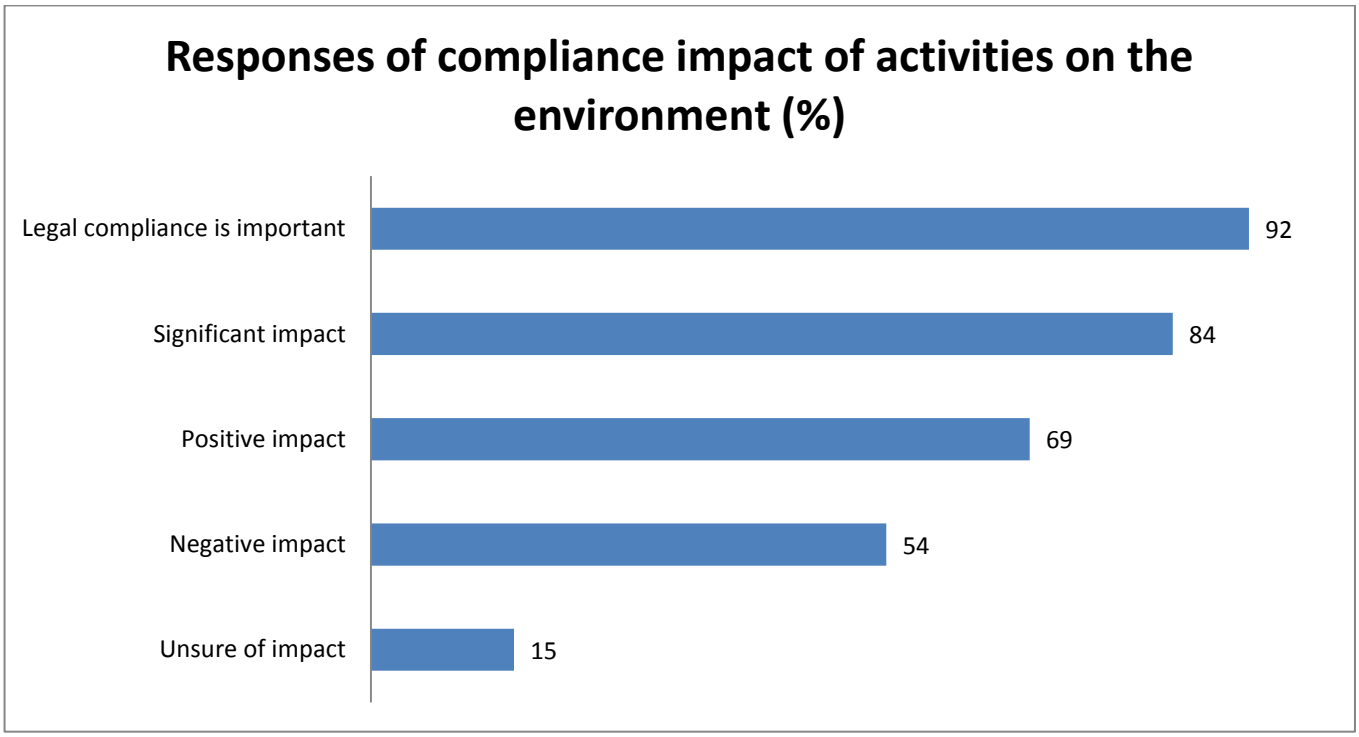


**Figure 4.5: Responses to compliance impact**

Table 4.6 provides additional information from the respondent manager with regards to specific EMS training, whether her or him has a tertiary qualification related to EMS, whether her or him has a tertiary qualification in general and whether the overall awareness of the EMS has shown improvement.

**Table 4.6: Company responses**

| Geographical Area | Industry Sector | Co Size (empl)[2] | Total Cost Saving p.a | Est. Cost of EMS p.a. | Est. Cost of EMS implementation | Mgr. Exp (yrs)[3] | Mgr. EMS Training | Mgr. 3° Qual in EM[4] | Mgr. 3° Qual[5] | Awareness improved |
|---|---|---|---|---|---|---|---|---|---|---|
| Durban | Automotive | 891 | R 3 385 915 | R 75 000 | R 95 000 | 8 | Y | N | Y | Substantial |
| NMBM | Automotive | 315 | R 2 781 000 | R 70 000 | R 90 000 | 13 | Y | N | Y | Some Change |
| NMBM | Automotive | 605 | R 2 780 791 | R 70 000 | R 110 000 | 8 | Y | N | Y | Substantial |
| NMBM | Automotive | 191 | R 1 250 000 | R 80 000 | R 95 000 | 9 | Y | y | Y | Substantial |
| Durban | Automotive | 87 | R 395 349 | R 80 000 | R 100 000 | 6 | Y | N | Y | Some Change |
| NMBM | Rubber & Plastic | 170 | R 330 000 | R 70 000 | R 80 000 | 12 | Y | N | Y | Some Change |
| NMBM | Automotive | 365 | R 240 000 | R 70 000 | R 125 000 | 9 | Y | N | Y | Substantial |
| East London | Rubber & Plastic | 135 | R 220 000 | R 70 000 | R 85 000 | 5 | Y | y | Y | Some Change |
| NMBM | Chemical | 228 | R 200 000 | R 75 000 | R 85 000 | 5 | Y | y | Y | Some Change |
| NMBM | Automotive | 1200 | R 200 000 | R 70 000 | R 85 000 | 20 | Y | y | Y | Substantial |
| NMBM | Food | 1800 | R 365 000 | R 75 000 | R 140 000 | 6 | Y | Y | Y | Some Change |
| NMBM | Rubber & Plastic | 369 | R 60 000 | R 75 000 | R 90 000 | 10 | Y | Y | Y | No change |
| George | Chemical | 130 | R 60 000 | R 45 000 | R 100 000 | 2 | Y | N | N | Substantial |
| Average | | | R 943 697 | R 71 154 | R 98 462 | 9 | | | | |

[2] Number of employees.

[3] Number of years of experience the managers implementing ISO 14001 have.

[4] Managers with tertiary qualification specific to Environmental Management / Science

[5] Managers with a tertiary qualification

## 4.11 Evaluation of statistical correlation between data variables

According to Statistics Solutions, (2018), in order to evaluate the correlation of sets of two variables in the statistical data obtained, the Kendall rank correlation and Spearman's rank correlation was used.

The authors intimate that in statistics, the Kendall rank correlation coefficient, commonly referred to as **Kendall's tau-b,** is a nonparametric statistical measure of the strength and direction of association that exists between two variables measured on at least an ordinal scale. Kendall's Tau is usually of smaller values than Spearman's rho correlation. The calculations are based on concordant and discordant pairs; it is insensitive to error; and the P values are more accurate with smaller sample sizes.

They further suggest that, conversely, the Spearman's rank correlation coefficient or Spearman's **rho**, is a nonparametric measure of rank correlation or relationship between between the rankings of two variables. The result will always be between 1 and minus 1. Spearman's rho usually has larger values than Kendall's Tau. The calculations are based on deviations; it is much more sensitive to error and discrepancies in data.

The presentation also notes that when comparing the data of the two variables, the correlation analyses measure the strength of the relationship between two variables. Evaluation of the calculated rankings, a positive correlation (+ value) signifies that the ranks of both the variables are increasing. On the other hand, a negative correlation (- value) signifies that as the rank of one variable is increased, the rank of the other variable is decreased.

The null hypothesis is that there is no association between the variables under study.

The main advantages of using Kendall's tau are as follows:

- The distribution of Kendall's tau has better statistical properties.
- The interpretation of Kendall's tau in terms of the probabilities of observing the agreeable (concordant) and non-agreeable (discordant) pairs is very direct.
- In most of the situations, the interpretations of Kendall's tau and Spearman's rank correlation coefficient are very similar and thus invariably lead to the same inferences.

It was found that there is a weak relationship (not statistically significant) between the number of employees and cost savings (Figure 4.6). Some larger companies were not able to realise more financial benefits than the smaller ones.

**Correlations**

| | | | No of employees | Cost savings |
|---|---|---|---|---|
| Kendall's tau_b | No of employees | Correlation Coefficient | 1.000 | .026 |
| | | Sig. (2-tailed) | . | .903 |
| | | N | 13 | 13 |
| | Cost savings | Correlation Coefficient | .026 | 1.000 |
| | | Sig. (2-tailed) | .903 | . |
| | | N | 13 | 13 |
| Spearman's rho | No of employees | Correlation Coefficient | 1.000 | .008 |
| | | Sig. (2-tailed) | . | .979 |
| | | N | 13 | 13 |
| | Cost savings | Correlation Coefficient | .008 | 1.000 |
| | | Sig. (2-tailed) | .979 | . |
| | | N | 13 | 13 |

**Figure 4.6: Correlation of company size (expressed as number of employees) vs. cost saving realised**

It was also found that there was virtually no relationship between initial costs and number of employees (see Figure 4.7), i.e. small companies face similar costs to large ones. . This could be a significant hurdle for smaller companies to adopt EMS.

**Correlations**

| | | | No of employees | Initial costs |
|---|---|---|---|---|
| Kendall's tau_b | No of employees | Correlation Coefficient | 1.000 | .160 |
| | | Sig. (2-tailed) | . | .458 |
| | | N | 13 | 13 |
| | Initial costs | Correlation Coefficient | .160 | 1.000 |
| | | Sig. (2-tailed) | .458 | . |
| | | N | 13 | 13 |
| Spearman's rho | No of employees | Correlation Coefficient | 1.000 | .230 |
| | | Sig. (2-tailed) | . | .449 |
| | | N | 13 | 13 |
| | Initial costs | Correlation Coefficient | .230 | 1.000 |
| | | Sig. (2-tailed) | .449 | . |
| | | N | 13 | 13 |

**Figure 4.7: Correlation of company size (expressed as number of employees) vs. initial cost of implementing ISO 14001**

As can be seen in Figure 4.8, there is almost no relationship between the number of employees and the annual costs, which indicates that it is generally harder for smaller companies to implement an EMS as the costs make up a larger portion of its income.

**Correlations**

| | | | No of employees | Costs pa |
|---|---|---|---|---|
| Kendall's tau_b | No of employees | Correlation Coefficient | 1.000 | .061 |
| | | Sig. (2-tailed) | . | .792 |
| | | N | 13 | 13 |
| | Costs pa | Correlation Coefficient | .061 | 1.000 |
| | | Sig. (2-tailed) | .792 | . |
| | | N | 13 | 13 |
| Spearman's rho | No of employees | Correlation Coefficient | 1.000 | .050 |
| | | Sig. (2-tailed) | . | .871 |
| | | N | 13 | 13 |
| | Costs pa | Correlation Coefficient | .050 | 1.000 |
| | | Sig. (2-tailed) | .871 | . |
| | | N | 13 | 13 |

**Figure 4.8: Correlation of company size (expressed as number of employees) vs. annual cost of maintaining an EMS**

Although there is some value in employing people with a great deal of experience, Figure 4.9 indicates that there is a weak positive relationship between the cost savings and the number of years of experience the management implementing the EMS had. Thus, hiring experienced consultants to help with implementation may make financial sense.

**Correlations**

| | | | Years of experience | Cost savings |
|---|---|---|---|---|
| Kendall's tau_b | Years of experience | Correlation Coefficient | 1.000 | .213 |
| | | Sig. (2-tailed) | . | .324 |
| | | N | 13 | 13 |
| | Cost savings | Correlation Coefficient | .213 | 1.000 |
| | | Sig. (2-tailed) | .324 | . |
| | | N | 13 | 13 |
| Spearman's rho | Years of experience | Correlation Coefficient | 1.000 | .281 |
| | | Sig. (2-tailed) | . | .352 |
| | | N | 13 | 13 |
| | Cost savings | Correlation Coefficient | .281 | 1.000 |
| | | Sig. (2-tailed) | .352 | . |
| | | N | 13 | 13 |

**Figure 4.9: Correlation of work experience of EMS champion vs. cost saving realised**

The analysis in Figure 4.10 shows that years of experience had an inverse relationship with the initial costs and annual costs, which are an indication that more experienced staff, may not necessarily be in a position to control some of the costs of an EMS, that is, they are unavoidable.

**Correlations**

| | | | Years of experience | Costs pa | Initial costs |
|---|---|---|---|---|---|
| Kendall's tau_b | Years of experience | Correlation Coefficient | 1.000 | -.062 | -.260 |
| | | Sig. (2-tailed) | . | .791 | .237 |
| | | N | 13 | 13 | 13 |
| | Costs pa | Correlation Coefficient | -.062 | 1.000 | .142 |
| | | Sig. (2-tailed) | .791 | . | .549 |
| | | N | 13 | 13 | 13 |
| | Initial costs | Correlation Coefficient | -.260 | .142 | 1.000 |
| | | Sig. (2-tailed) | .237 | .549 | . |
| | | N | 13 | 13 | 13 |
| Spearman's rho | Years of experience | Correlation Coefficient | 1.000 | -.056 | -.303 |
| | | Sig. (2-tailed) | . | .855 | .315 |
| | | N | 13 | 13 | 13 |
| | Costs pa | Correlation Coefficient | -.056 | 1.000 | .120 |
| | | Sig. (2-tailed) | .855 | . | .696 |
| | | N | 13 | 13 | 13 |
| | Initial costs | Correlation Coefficient | -.303 | .120 | 1.000 |
| | | Sig. (2-tailed) | .315 | .696 | . |
| | | N | 13 | 13 | 13 |

**Figure 4.10: Correlation of work experience of EMS champion vs. the initial cost and annual cost of maintaining an EMS**

## 4.12 General discussion of responses

The survey data feedback indicated that the respondent companies were located in four geographic locations, with the majority of respondents being from the NMBM. A similar trend was evident when the data indicated that the majority of respondents were also active in the automotive economic cluster. The main reason for this, which was borne out by the research data, is that it is a requirement of the automotive companies that their first tier suppliers have to be ISO 14001 certified. The average working experience in the field of environmental management of the individual respondents was

nine years, and all of them had at least attended ISO 14001 awareness training. Their understanding of ISO 14001 requirements, as well as the South African environmental legal requirements, was generally well grounded. The responses indicated that the financial benefit derived from the effective implementation of ISO 14001 was directly related to the type of product manufactured and the subsequent recycling initiatives. This was because the process waste had become a new income stream, as it could now be sold as a by-product to other companies for downstream beneficiation. The feedback revealed that companies in the automotive sector achieved the biggest financial impact related to the effective implementation of the EMS. These respondents suggested that the main drivers of the large cost savings were a reduction in waste as a result of improved production processes. The recycling of waste also helped as this waste was then sold as a by-product of the production process. The reduction in raw material costs due to the lessening of process waste; and the reduction in energy costs by installing energy-efficient motors, drives and lighting, as well as effective machine maintenance and repairing of steam, compressed air and water leaks.

As the responses recorded in Table 4.1 indicates that the extent of the financial benefits of the EMS was not dependent on the qualifications and/or years of experience of the respondents. The data suggest rather that the financial impact was dependent on the type of product manufactured and the subsequent recycling initiatives instituted. The size of the company (i.e. the number of employees) did not impact the effectiveness of the EMS in terms of total annual cost savings. The geographical location does not impact the cost savings realised, i.e. the results do not indicate that companies situated in NMBM showed a bigger cost saving just because of their location (see Figure 4.11). The biggest annual cost savings of the EMS were realised by four companies in the automotive sector. Feedback from the respondents revealed that the main drivers of these large cost savings were the following: (1) a reduction in waste as a result of improved production processes; (2) recycling initiatives that sell off processing waste as by-products to other companies; (3) a reduction in raw material costs due to a lessening of process waste; and (4) a reduction in energy costs.


**Figure 4.11: Map of South Africa showing the geographic location of the sample companies** (adapted from Turok, 2014, p16)

The overall opinion of the respondents was that the success of ISO 14001 is linked to the knowledge and skill that their companies had gained from managing the ISO 9001 quality management system. In addition, the respondents also said that the sound commitment from management had a positive influence on everyone in the organisation, as could be seen by the effective training of employees and employee involvement in continual improvement programmes and suggestion schemes. Despite this, many respondents felt that it was still left to the SHEQ department to manage the process. The respondents could not express an opinion on whether the company had managed to increase its market share, as they did not see an increase in production volumes. Each respondent offered estimated and/or calculated financial values, which indicated a positive impact resulting from the implementation of ISO 14001.

On the downside, the respondents were of the opinion that ISO 14001 is expensive to implement and maintain, and said that there is a general lack of awareness of the statutory and regulatory requirements related to the environment. Almost all (92%) of the respondents were convinced that environmental compliance is important to their organisation, while 84% thought that their company's activities have a significant

impact on the environment. Over two-thirds (69%) thought that the impact was positive, while 16% thought that it was negative. Internal audits, which include legal compliance, are conducted at regular intervals, and all respondents expressed confidence that their organisations are compliant with the statutory, regulatory and other requirements of ISO 14001.

## 4.13 Summary

This chapter presented the responses received from company representatives to the survey questionnaire. It provided information on the issues involving ISO 14001 EMS implementation, both positive and negative, after the associated financial benefits were evaluated and quantified. From the information gathered and analysed in the chapter, it has become clear that despite the associated costs, the implementation of ISO 14001 EMS has resulted in improved financial performance amongst the companies sampled.

Chapter 5 will present the results of the one-on-one in-depth interviews.

# CHAPTER 5: FINDINGS OF THE STRUCTURED INTERVIEWS

## 5.1 Introduction

This chapter presents the findings of the results obtained from the structured interviews. The selected interviewees were sampled from the survey respondents, and were all middle to senior management individuals who were actively involved in the management of the environmental management system of the organisations they represented. Of the 13 companies that responded to the survey, ten were available and selected for one-on-one, structured interviews, which were conducted both telephonically (six interviewees) and in person (four interviewees).

The interviews were conducted in order to verify the responses to the questionnaires, as well as to elicit additional information which may have been overlooked in the questionnaires. This may result in more effective information as the interviewer and interviewee may be able to further discuss the answers for clarity if required.

The final section is a summary of the discussion of the results, which concludes the chapter.

## 5.2 Structured Interview Questions

The in-depth interview questions focused on the positive financial impact of the implementation of ISO 14001 on the selected companies' overall environmental performance, and aimed to obtain additional descriptions of the actual interventions and improvements experienced and realised by the organisation.

The categories of subjects explored included the following (its relation to specific questions in section 3.6 in brackets):

a. Motivation for the implementation of an EMS.
b. Constraints of implementation.
c. Benefits of implementation (6,7,8,9)
d. Decrease in pollution at source production processes (5)
e. Reduction in process waste (1)
f. Impact on time management (10)
g. Cost reduction (5)

h. Re-use of process scrap (2)
i. Recycling of waste material (3; 4)
j. Continual improvement initiatives implemented, such as raw materials, machine upgrades, energy efficiency, etc (5,6,7,8,9)
k. Upgrades, energy efficiency, etc.

The interview questions are tabulated in Table 4.4. Additional information was gleaned from the interviews that were not covered by the emailed questionnaire survey. These responses were found to be relevant and useful, and were thus included in the feedback discussion.

Based on the responses to the interview questions, the following data are presented:

## 5.3 Motivation for ISO 14001 Certification

As noted in column K of Table 5.1, the two motivations for obtaining certification to the requirements of ISO 14001 were a corporate initiative (4/10 or 40% of interviewees) or a customer requirement (6/10 or 60% of interviewees). Thus, the most prevalent directive to implement the ISO 14001 was largely influenced by the customer requirements. A response from Interviewee 8 was, *"We had no choice other than to implement ISO 14001 as our main customers who are automotive original equipment manufacturers (OEM), will not do business with us if we do not have certification"*. This sentiment was repeated by all of the sample companies in the automotive sector.

In addition, companies implemented an EMS if it could be substantiated that it amounted to cost savings, as well as if an increase in business opportunities could be realised. This was confirmed by Interviewee 5 from the chemical sector, who said, *"My boss told me to prove that ISO 14001 worked by showing him the bottom line"*. Column F of Table 5.1 provides an indication of the annually realised cost saving per individual company which ranges from R 180 000 to R 2 781 000 per annum. All of the interviewed companies indicated cost savings as a result of implementing an EMS. The total amount of annual cost saving realised by the 10 selected companies interviewed

amounted to R 8 528 000 per annum, equating to an average cost saving for the sample of R 852 800 per annum.

Other organisations wanted to project an image of being an environmentally responsible entity, banking that the implementation of an EMS would generate such an image with their customers, as well as with the general public. As stated by the EMS manager of a company in the rubber sector, Interviewee 7, *"…although it is not specifically required, our ISO 14001 certification definitely gives us an advantage when dealing with continued orders from the mines, as our products are deemed to be manufactured in environmentally-friendly processes"*.

Column I of Table 5.1 below lists the constraints experienced in implementing and effectively maintaining the EMS. Four of the 10 interviewees (40%) indicated that time (for meetings, awareness training, feedback, impact assessment, investigations to determine the root cause/s of incidents and non-conformities, internal audits, management reviews, reports, action plans to clear non-conformities) and funding constraints ( for training, legal compliance audits, monitoring and measurement of key indicators, awareness posters, waste management, improvement initiatives, training ) were experienced. Sixty percent (6/10) interviewees added the availability of adequate Human Resource for the Environmental department as a constraint

| A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| **Company Name** | **Interviewee Number** | **Geographical Area** | **Industry Sector** | **Co Size** | **Annual Cost Saving** | **Est. Cost of EMS p.a.** | **Est. initial Cost of EMS** | **Constraints of EMS** | **Main Benefits** | **Motivation for ISO 14001** |
| Floorworx | 1 | East London | Rubber & Plastic | 135 | R 230 k | R 70 k | R 85 k | Time / HR / Funding | Cost Saving / Awareness | Corporate |
| Dana Spicer Axle | 2 | NMBM | Auto | 365 | R 240 k | R 70 k | R 125 k | Time / Funding | Cost Saving / Awareness | Customer |
| Bridgestone | 3 | NMBM | Rubber & Plastic | 369 | R 180 k | R 75 k | R 90 k | Time / HR / Funding | Cost Saving / Awareness | Customer |
| Coca Cola Fortune | 4 | NMBM | Food | 1800 | R 336 k | R 75 k | R 140 k | Time / Funding | Cost Saving / Awareness | Corporate |
| Eveready | 5 | NMBM | Chemical | 228 | R 200 k | R 75 k | R 85 k | Time / HR / Funding | Cost Saving / Awareness | Corporate |
| GMSA | 6 | NMBM | Auto | 1200 | R 200 k | R 70 k | R 85 k | Time / Funding | Cost Saving / Awareness | Corporate |
| Contitech | 7 | NMBM | Rubber & Plastic | 170 | R 330 k | R 70 k | R 80 k | Time / Funding | Cost Saving / Awareness | Customer |
| Linde & Wiemann | 8 | NMBM | Auto | 191 | R 1 250 k | R 80 k | R 95 k | Time / HR / Funding | Cost Saving / Awareness | Customer |
| Shatterprufe Neave | 9 | NMBM | Auto | 605 | R 2 781 k | R 70 k | R 110 k | Time / HR / Funding | Cost Saving / Awareness | Customer |
| Shatterprufe Struandale | 10 | NMBM | Auto | 315 | R 2 781 k | R 70 k | R 90 k | Time / HR / Funding | Cost Saving / Awareness | Customer |

**Table 5.1: Interview Responses**

## 5.4 Requirements for an EMS from the Automobile Industry

The majority of automobile manufacturers (OEMs) have recently made their commitment to preserving the environment known by being certified to ISO 14001 themselves, and have subsequently requested – and in some cases forced - their first tier suppliers to follow suit, by requiring them to demonstrate their environmental responsibility by being certified to ISO 14001 EMS. OEMs have introduced ongoing recycling projects internally and have introduced programmes to search for initiatives that will increase the ratio of recycled materials and components in vehicles being produced. As these programmes have been extended to their suppliers, they in turn are encouraged to investigate the use of both eco-effective and eco-friendly components for the motor vehicles of the future. The above is borne out by the literature detailed in Chapter 2.

## 5.5 Constraints in Managing an EMS

When probed as to what the actual time and costs are for implementing and managing an EMS, the following responses were declared, as recorded in Annexure 2 (Table 5.2):

a. Regular meetings of the relevant role players had to be held in order to ensure they were well-informed and that the profile of the EMS was enhanced (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10).
b. Audits of the EMSes needed to be planned and conducted, and concise records and reports needed to be compiled and filed (Interviewees 1, 3, 5, 8, 9, 10).
c. The investigation of environmental incidents required adequate time for teams to apply their minds to determine the cause/s, and to develop and implement effective corrective and preventative actions (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10).
d. Adequate time and funding was required to ensure the appropriate training of employees to increase their environmental awareness, as well as to determine the cause/s of non-conformities and to conduct effective incident investigations (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).
e. Money was required to purchase environmental awareness posters (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10).

f. The cost of monitoring and measuring key indicators, such as the analysis of water samples (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10).

The above responses can be thematically grouped into the following three categories:
(a, b, c, d) = Time.
(b, c, d) = Human resources.
(d, e, f) = Funding.

Table 5.2 below expands on the previous tabulation (table 5.1) and lists the financial impacts of the EMS. Column H lists the financial realised due to the reduction in waste ranging from R 60 000 to R 2 400 000 resulting in a total benefit of R 6 023 000 per annum with an average of R 602 300 for the sampled interviewees.

From the data in column I of Table 5.2 it can be seen that seventy percent (7/10) of interviewees indicated that they were able to re-use scrap material in their process with values ranging from R 40 000 to R 381 000 per annum. The other 3 interviewees (30 %) could not re-use their process scrap due to the nature of the business i.e. either the food industry (scrap goes to landfill) or automotive assembly whose process scrap were recycled.

The financial benefit realised due to the recycling of process waste is listed in column J of Table 5.2 below and indicates values ranging from R 20 000 to R 800 000 annually with a combined total of R 1 339 000 and an average of R 133 900 per annum for the 10 sampled interviewees.

The information listed in columns K and L of Table 5.2 confirms that all the interviewees noted an improvement in EMS awareness in their respective organisations and the the continual improvement initiatives were related to effective waste management, water resource management and energy efficiency projects.

| A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Company Name** | **Interviewee Number** | **Motivation** | **Constraints of EMS** | **Main Benefits** | **Cost Saving p.a** | **Est. Cost of EMS p.a.** | **Waste reduction** | **Scrap Re-use** | **Recycling** | **Awareness Improved** | **Continual Improvement Initiatives** |
| Floorworx | 1 | Corporate | Time / HR / Funding | Cost Saving | R 230 k | R 70 k | R 100 k | R 42 k | R 35 k | Yes | Waste/Water/Energy |
| Dana Spicer Axle | 2 | Customer | Time / Funding | Cost Saving | R 240 k | R 70 k | R 80 k | R 60 k | R 60 k | Yes | Waste/Water/Energy |
| Bridgestone | 3 | Customer | Time / HR / Funding | Cost Saving | R 180 k | R 75 k | R 60 k | R 60 k | R 60 k | Yes | Waste/Water/Energy |
| Coca Cola Fortune | 4 | Corporate | Time / Funding | Cost Saving | R 336 k | R 75 k | R 173 k | N/A | R 192 k | Yes | Waste/Water/Energy |
| Eveready | 5 | Corporate | Time / HR / Funding | Cost Saving | R 200 k | R 75 k | R 90 k | R 60 k | R 72 k | Yes | Waste/Water/Energy |
| GMSA | 6 | Corporate | Time / Funding | Cost Saving | R 200 k | R 70 k | R 120 k | N/A | R 65 k | Yes | Waste/Water/Energy |
| Contitech | 7 | Customer | Time / Funding | Cost Saving | R 330 k | R 70 k | R 150 k | R 180 k | R 20 k | Yes | Waste/Water/Energy |
| Linde & Wiemann | 8 | Customer | Time / HR / Funding | Cost Saving | R 1 250 k | R 80 k | R 450 k | N/A | R 800 k | Yes | Waste/Water/Energy |
| Shatterprufe Neave | 9 | Customer | Time / HR / Funding | Cost Saving | R 2 781 k | R 70 k | R 2 400 k | R 381 k | R 35 k | Yes | Waste/Water/Energy |
| Shatterprufe Struandale | 10 | Customer | Time / HR / Funding | Cost Saving | R 2 781 k | R 70 k | R 2 400 k | R 381 k | R 35 k | Yes | Waste/Water/Energy |

**Table 5.2: Interview Responses**

### 5.5.1 Time

Time was noted by all the interviewees, but was specifically addressed by Interviewee 7: *"Innovative planning was required to ensure regular awareness sessions and work-group meetings were held, training to conduct internal audits and to record identified non-conformities were scheduled, time was allocated to write reports, conduct root-cause analyses, develop and implement corrective actions, and to close the documentation and records loop"*.

### 5.5.2 Human resources

As per the training needs analysis, in order to realise the human capital development and expertise required by ISO 14001, Interviewee 2 stated that *"candidates needed to be identified and selected who had the potential to be trained to be environmental officers, impact assessors, incident investigators, how to capture the data and to present the findings and the proposed outcomes to management teams. In addition, regular monitoring of their effectiveness and individual development was now required to be conducted by the line managers in coordination with the company's human capital department"*.

### 5.5.3 Funding

In order to achieve the training and awareness objectives, as well as to get the selected individuals to effectively execute the new and additional functions, companies have had to include the environmental objectives as stand-alone budget items for the appropriate managers. Interviewee 6 mentioned that, *"the environmental objectives and targets are now included in the key performance indicators of individual managers, with an overall budget allocated to the HSE department"*.

## 5.6 Benefits Derived from the Effective Implementation of an EMS

According to the feedback from the interviewees – as tabulated in Table 5.1 – the most important benefits of implementing an ISO 14001 EMS were cost savings and

awareness. Sixty percent of the interviewees reported that upon initial implementation, the members of their company management teams were mostly sceptical, and some felt that the EMS had been forced upon them, particularly by their customers. A response from Interviewee 2 from the auto sector was that *"the OEMs are our bread and butter – what they want, we give them. They want us to have ISO 14001, so we give them ISO 14001"*. According to the interviewees this mind set had changed over time however, when the process improvement initiatives were implemented and the cost benefits were calculated and quantified. Interviewee 7 from the rubber and plastics sector commented that *"our monthly municipal statements indicate that our usage of electricity and water volumes has reduced"*.

In addition, the interviewees observed that another paradigm shift has taken place in that environmental management has transitioned; it is now no longer the domain of a select few such as the SHE department, because EMS "thinking" has begun to permeate all facets of the business. This had become evident as the success of the ISO 14001 EMS demanded that staff across all departments and organisational levels become involved, and that everybody in the organisation was made aware of how his or her work activity impacted on the environment. Further responses included that the culture of a shared responsibility of caring for the environment was becoming entrenched in the organisations, which could be observed by renewed internal practices such as using the dedicated waste bins provided by actively segregating waste, switching off lights when leaving offices, taking part in the environmental improvement suggestion programmes, and contributing to improved housekeeping. Interviewee 9 from the auto sector provided this comment on employee attitude: *"…the EMS has now become a family affair as employees are using the awareness information and continual improvement initiatives for their children's school assignment projects – we know the effort is worth it"*.

The interviewees also highlighted the following additional benefits that are directly related to the implementation of their EMS, as recorded in Table 5.2:

a. Continual improvement has become inherent in the overall company philosophy and suggestion schemes have been initiated (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).

b. Recycling and waste management programmes are included in the key performance areas (KPAs) of line managers (Interviewees 1, 2, 3, 4, 7, 8, 9, 10).
c. ISO 14001 implementation has resulted in adherence to other associated QMS standards, i.e. ISO 9001 and OHSAS 18001 (Interviewees 2, 7, 8, 9, 10).
d. The commitment of the company to the safety of employees has become more visible (Interviewees 2, 7, 8, 9, 10).
e. The operational controls in the processing area have improved (Interviewees 1, 2, 5, 6, 7, 8, 9, and 10).
f. Overall operating costs have been reduced (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).
g. Energy management is more effective (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).
h. Planned maintenance of machines and equipment has been introduced (Interviewees 1, 2, 3, 7, 9, 10).
i. Record keeping has become more effective (Interviewees 1, 2, 3, 5, 8, 9, 10).
j. Efficiencies have been improved (Interviewees 1, 5, 6, 8, 9, 10).
k. The financial bottom line has improved and profit margins have increased (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10).

The above responses can be thematically grouped into the following three categories:
(a, b, e, f, g, i, j, k) = Continual Improvement.
(e, g, h, j) = Energy Management.
(b, c, d, g, h) = Compliance.

### 5.6.1 Continual improvement

Interviewee 7 remarked that, *"Continual improvement initiatives were now part of the regular work-group meetings and suggestion schemes were introduced"*. In the sample organisations, particular emphasis was placed on initiatives that considered reductions in energy usage, reductions in machine downtime, and the reduction and re-use of water as well as waste management to improve efficiencies, as confirmed in the feedback from the surveys and the interviewee responses.

### 5.6.2 Energy management

The engineering division played an indispensable role in executing the initiatives to reduce energy usage (electricity, gas, compressed air, steam) in order for processing to be more efficient. Regular monitoring of energy usage was instituted, and graphical displays of energy use per production output (per production/shift teams) were placed on the notice boards to emphasise the highlights as well as where improvements and additional interventions were required. Interviewee 1 noted that *"…our fitters and electricians have a daily walk-about through the plant checking for both water leaks as well as steam leaks"*.

### 5.6.3 Compliance

The environmental objectives and targets, as well as the concomitant engineering initiatives, were driven by compliance requirements such as water reduction measures instituted by the local municipalities, electricity reduction demands from Eskom, gas emission limits set by local and national regulations, and the waste management requirements stipulated in the Environmental Management Waste Act, No 59 of 2008. Interviewee 1 stated that *"…we take regulatory compliance very seriously, which is why we use external legal specialists to update our legal register and to evaluate our internal compliance"*. This sentiment was echoed by Interviewee 10, who commented that, *"South Africa is a water-scarce country and therefore we must do everything in our power to ensure we preserve this scarce resource. To amplify this, the Nelson Mandela Bay municipality have a stepped charging model for water usage, which adds a financial punishment for over-use"*.

## 5.7 Waste Management Benefits

As a result of the effective implementation of their EMS, the majority of employees of the companies have become actively involved in seeking opportunities to minimise the creation of waste to be disposed of in landfill sites. In addition, continual improvement initiatives have been introduced in processing areas to improve the production processes, which have (a) minimised the generation of waste; (b) re-used the waste

products either back into themselves or in the production of other products; and (c) recycled that which could be re-used. Interviewee 7 from the rubber and plastic sector offered this comment on waste management: *"…it is amazing how many improvement initiatives come to the fore when people involvement is encouraged. We can re-process rubber compound when at the end of a production run we batch-off the leftover rubber on the mills into thinner strips (6 mm strips) instead of 10 mm which has resulted in less "scorching" of the compound. In the past we had to throw this compound away".* A response from Interviewee 4 from the food sector was, *"…in the past we could not be bothered to recycle as it was perceived to be too difficult. Now we understand that selling our used wooden pallets as a by-product for the manufacture of furniture is a recycling initiative".*

The waste management benefits can be grouped into the following three categories: (i) waste reduction; (ii) waste re-use; and (iii) energy reduction.

### 5.7.1 Waste reduction

The monitoring of process waste has become more focussed so as to quantify the waste generated. The effective management, collection and recycling of waste material has become a part of the overall business process of the sample companies, and this was reflected in the management reports. An example is the rubber compound on the processing mills at the end of production runs, which is now batched off in strips with a thickness less than 10 mm to facilitate easier cooling. As noted by Interviewee 7, *"This batched-off compound was reprocessed and resulted in less scorching of the compound due to a cooler processing memory of the rubber".*

### 5.7.2 Waste re-use

Interviewees 9 and 10 noted that, "*Instead of dumping process water, it was now recycled and used to flush toilets",* while Interviewee 1 commented that *"grease was used as machine lubricant in the place of oils, resulting in cost saving as well as less contamination of the process water".* Other initiatives which were put in place included the fact that used solvents were recovered, filtered and re-used for cleaning machines

and parts, and damaged wooden pallets were repaired for re-use on site or sold to furniture manufacturers. Some of the recyclable wastes identified were non-ferrous waste, used paper, used oil, redundant rubber conveyor belts and edge trims, used tyres, scrap metal (steel, aluminium, copper), used oil filters, used batteries, plastic, cardboard and e-waste. The effectiveness of the EMS was further emphasised by the fact that waste products are now used in the production of other value-added products, such as boiler ash which is sold off to be used as a filler raw material for the production of bricks, and waste oil is treated for re-use in the production process of base oils.

### 5.7.3 Energy reduction

More efficient automated systems have also been installed, which has resulted in optimised processing management, thereby leading to a reduction in process waste as well as the reduced consumption of energy (electricity, fuel, compressed air). Some of the interventions to achieve a reduction in energy usage include *"setting geyser temperatures at 50° Celsius, installing light emitting diode (LED) lamps and motion sensors in offices"*, as per Interviewee 4. Interviewees 2 and 3 both mentioned that *"we installed energy-saving shower heads (restricting water flow), thereby saving water and electricity"*. The engineering maintenance department of Interviewee 6 has *"implemented some programmes to manage water leaks and replacing fuel-burning lift trucks with ones powered by either batteries or liquefied petroleum gas, which reduced emissions"*.

## 5.8 Water Management

Some of the benefits mentioned that have been realised as a result of the renewed focus on water management include *"a reduction in the overall water consumption, as we are using the waste process water to flush toilets"* (Interviewee 9), while Interviewee 2 replied that *"we are using reclaimed grey water from the showers and wash basins to water the garden and lawns in the yard"*. Other benefit noted by Interviewee 8 with regards to water management was that *"we have improved our effectiveness of managing our water quality by regular monitoring of water pH and temperature before discharges into sewer as well as the effluent collection programme and storm water*

*monitoring"*. Interviewee 2 stated that *"we have implemented a conscious drive to explore recycling initiatives to reuse water in the manufacturing processes wherever possible"*. Interviewee 7, in turn, remarked that their organisation has implemented *"a water-leak awareness and repair as part of the regular maintenance system"*, while Interviewee 4 said that they were *"regularly report(ing) our water monitoring results for sewer to municipal authorities"*.

### 5.9. General Management

The interviewees confirmed that the overall management of their departments had improved, as regular internal audits to assess the environmental performance were now being conducted as required by ISO 14001 and the effective development of the organisation's environmental policy statement. In addition, key personnel have been trained in the management of their EMS, which includes identifying the environmental aspects of the companies' activities, and assessing the significant environmental impacts as well as the South African environmental legal requirements. Key personnel have been identified, trained and appointed with defined responsibilities and authority with regards to the environmental management system, including facilitating the monitoring and measuring of key environmental indicators. Interviewees 6, 7 and 8 noted that the setting of environmental objectives with targets are meaningful and based on the SMART principle – specific, measurable, achievable, realistic, and time-related: *"the EMS objectives are managed as an action plan with individual responsibilities allocated"* (Interviewee 7); *"The EMS objectives were linked to environmental management programmes to achieve the targets"* (Interviewee 8); *"Regular work-group meetings were held in all departments to improve awareness and environmental emergency drills were conducted at planned intervals to manage and prevent incidents such as accidental spillages and chemical releases"* (Interviewee 6).

## 5.10 Environmental Performance Monitoring

With regards to the monitoring of environmental performance, the interviewees noted that they were recording the following:

In terms of waste, all the interviewees (1, 2, 3, 4, 5, 6, 7, 8, 9, and 10) are segregating, monitoring and measuring the waste generated by their production processes. *"We are monitoring and measuring the overall waste generated; the contribution of waste to landfill; which waste could be re-used; which waste could be to recycled as well as the recovery and re-use of machine lubricants"* (Interviewee 2). The consumption of electricity, water and energy is also monitored by all Interviewees, and organic solvent usage is monitored by Interviewees 3 and 7. Interviewees 1, 3, 4 and 8 record the quantity and quality (pH and trace elements) of effluent generated, as well as the overall water usage and disposal quantities. The water quality discharged to sewerage (total dissolved solids, total oxygen demand) is monitored by Interviewees 1, 3, 4, 8, 9 and 10, while the make-up and quality of stack emissions are measured by Interviewees 2 and 3. The monitoring of the usage of paper and the generating of paper waste is done by Interviewees 3, 4 & 6, and the reporting on environmental management projects and the associated costs are conducted by all the Interviewees. Interviewee 8 noted that, *"We are monitoring and measuring the volume of water as well as the pH and also the trace elements make-up of the process water which we discharge into sewer as per the requirements of our municipal permit"*.

## 5.11 Environmental Management Programmes (EMPrs)

The following is a summary of the EMPs implemented by the sample companies as actions to achieve their EMS objectives:

Process water is used to flush toilets (Interviewees 9 and 10); clear roof sheeting was installed to facilitate daylight harvesting, resulting in a reduction in electricity use (Interviewee 9); some companies have implemented a steam management programme which includes checking for and fixing steam leaks, coupled with the lagging of steam pipes to retain heat and conserve energy (Interviewee 7); drive motors and gears have

been synchronised to ensure efficient energy management (Interviewee 1); staggered start-ups of machines and equipment were introduced to reduce energy spikes (Interviewees 1 and 7); machine cycle times have been optimised to ensure efficient production runs (Interviewees 2, 3 and 4); reduced-output compressors have been installed to conserve energy usage (Interviewee 7); energy-saving lighting has been installed (Interviewees 4, 7, 9 and 10); grease has replaced oil as a machine lubricant to reduce waste (Interviewee 1); and planned maintenance programmes for machines and equipment have been set up to ensure their reliability and optimal functionality (Interviewees 1, 2, 3, 5, 7, 8, 9 and 10).

Other associated additional continual improvement programmes have also been initiated to reduce the consumption of energy (electricity, steam, compressed air, fuel, gas) and the use of natural resources (water, coal, gas) in order to prevent pollution, which could ultimately result in the minimisation or elimination of environmental damage.

Additional programmes include the lowering of geyser temperature settings in order to reduce electricity use (Interviewees 3, 4, 9 and 10); the installation of motion-sensor light switches in offices (Interviewees 6, 7, 9 and 10); the installation of water-saving shower heads in ablution blocks (Interviewees 3, 4, 6, 7, 9 and 10); a water-leak management programme to prevent wastage and preserve a scarce natural resource (Interviewees 4, 7 and 8); forklift trucks powered by diesel/petrol have been replaced with battery/gas powered machines to reduce emissions (Interviewee 6); lubricant recovery programmes have been employed and products using hydrocarbon solvents have been replaced with water-based products (Interviewee 6).

Supplementary initiatives include the use of water-based, bio-degradable cleaning chemicals (Interviewee 4); the collecting of e-waste for environmentally-friendly disposal and recovery of precious metals (Interviewees 1, 2, 3, 4, 5, 6 and 8); the recycling of non-ferrous waste (Interviewee 7); the recycling of food waste by composting and removal by pig farmers (Interviewees 3, 4 and 5); the separation of waste into streams (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10); and deliberate

initiatives to reduce, reuse and recycle waste (Interviewees 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10).

## 5.12 General Discussion of Responses

The interviews were conducted in order to corroborate the responses to the survey questionnaire, as well as to extract additional material which may have been overlooked in the answers to questionnaires. The feedback from the one-on-one interviews (both telephonic as well as face-to-face) did exactly that, i.e. no discrepancies were found between the feedback from the surveys versus the feedback from the interviews, which confirmed that the biggest financial benefit derived from ISO 14001 is the recycling initiatives. Process waste has now become a new income stream, as it is being sold as a raw material to other companies for use in their processes - boiler ash was sold off as a filler raw material for the production of bricks. Process water was recycled and used to flush toilets, used solvents were recovered, filtered and re-used for cleaning machines and parts, damaged wooden pallets were either repaired or re-used on site or it was sold to upholsterers and furniture manufacturers. Non-ferrous waste, used paper, used oil, redundant rubber conveyor belts and edge trims, used tyres, scrap metal (steel, aluminium, copper), used oil filters, used batteries, plastic, cardboard and e-waste were all recycled. The waste process oils were treated and re-used in base oil production.

The interviewees advised that the main improvements are the reduction in processing waste due to improved production processes, a reduction in raw material costs, reduced energy and water costs, and the recycling of waste. The interviewees felt that continual improvement initiatives are becoming a normal way of thinking in their companies, and regular two-way communication sessions are taking place. The overall opinion of the interviewees was that ISO 14001 has been a success, which was demonstrated by the financial reports that highlighted the economic benefits.

## 5.13 Summary

This chapter was crucial in the presentation of the feedback received from the company representatives during the structured interviews. It confirmed, and in some instances augmented, the information received from the survey questionnaires involving the ISO 14001 EMS implementation and the associated quantified financial impact - both the opportunities and challenges. From the analysis of the information presented and evaluated, it can safely be concluded that despite the costs associated with the implementation and management of ISO 14001, overall the effective implementation of an EMS has been value-adding, and has resulted in the improved financial performance of the companies tested in the research sample.

Chapter 6 now follows in which the interpretations of the findings are discussed in order to draw conclusions as guided by the research.

# CHAPTER 6: Discussion of Results

## 6.1 Introduction

Chapter 4 provided an analysis of the respondents' feedback to the questions outlined in the survey questionnaire, while Chapter 5 provided an analysis of the in-depth interview responses. This chapter discusses the researcher's interpretation of the findings in order to draw conclusions as guided by the research. Chapter 6 therefore presents the inferences drawn from both the analysis of the results from the previous two chapters, as well as the objectives of the study in consideration of the literature review in Chapter 2.

## 6.2 Aim of the research

Several research studies, including those of Morrow and Rondinelli (2002) and Thakore *et al.* (2013) revealed that an EMS such as ISO 14001 improves an organisation's overall performance if measures such as environmental, operational and financial metrics are used. They noted a range of benefits such as cost savings resulting from a reduction in process waste, as well as savings from the efficient management of resources, i.e. water, electricity, steam and gas. Yet there is little published work, other than that of Anderson, Jürgen and Alan (2009), which focuses on the financial and other benefits that accrue specifically to South African organisations that have adopted ISO 14001. The aim of this study was thus to assess the financial benefits associated with the adoption of ISO 14001 by South African companies. This study focussed on various South African organisations in different manufacturing sectors, such as the chemical, engineering, rubber and plastics, food and automotive industries, which have been certified to ISO 14001 (EMS).

The study sought to determine if the adoption of an EMS can assist an organisation to improve its environmental performance by increasing its resource efficiency, resulting in a reduction of waste and energy use and thereby realising financial savings. In this regard, the study showed that there was a significant overall cost benefit, which was comprised of a reduction in process waste and a concomitant reduction in the use of

virgin raw materials. The companies were also able to re-use and recycle some of their waste streams as well as sell their process waste as by-products. Companies further improved their energy utilisation and a general improvement in environmental awareness and overall business management was noted.

### 6.3 Why did the companies under study implement ISO 14001 EMS?

The study found that the majority of respondents were active in the automotive economic cluster, and that automotive companies (OEMs) such as Ford, General Motors, Nissan and Toyota operating in South Africa are all associates of multi-national companies, which require that their first tier suppliers have to be ISO 14001 certified. These OEMs have initiated their own internal recycling projects and programmes to explore interventions to grow the proportion of recyclable constituents and elements in their vehicles, and have subsequently pressured their suppliers to initiate similar programmes.

The research thus found that for most of the sampled companies, the main motivation for implementing ISO 14001 as an EMS was that it was a corporate imperative or a customer requirement. OEM customers such as the Ford Motor Corporation (Ford, 2001), which successfully implemented ISO 14001 and realised significant paybacks in the form of cost savings, wanted their suppliers to reap the same benefits. Following close on Ford's initiative, General Motors issued their suppliers with a target date to be ISO compliant (GMSA, 2009a; 2009b). The overwhelming response from the respondents was that the implementation of ISO 14001 resulted in continued orders for the company**,** that is, they were able to retain their automotive clients.

### 6.4. Can ISO 14001 EMS lead to an improvement in process efficiency?

The majority of the respondents mentioned various improvements, including a reduction in the consumption of natural resources such as water and the generation of less process waste. According to ISO (2011b), a Pretoria Portland Cement (PPC) study noted that as the operational controls in the processing area improved, so reductions in process waste, emissions and product defects, as well as a more streamlined production

process, were observed. Other improvements noted were the more efficient use of energy resources and the realisation of the 3Rs for waste, i.e. reduction, re-use and recycling. The PPC study further indicated that companies showed improved and more efficient production processes, a reduction in process waste, improved energy utilisation and the re-use of process water after having implemented ISO 14001. In addition, as improvement initiatives such as the re-use of process waste were put in place, the organisation realised a reduction in the use of virgin raw materials. One of the interviewees also remarked that continual improvement initiatives had become part of the agenda of the regular work-group meetings, and that suggestion schemes had been introduced.

In the sample organisations, particular emphasis was placed on initiatives that considered reductions in energy usage, reductions in machine downtime, and the reduction and re-use of water as well as waste management to improve efficiencies. The execution of the energy reduction initiatives to realise the processing efficiency improvements was the responsibility of the engineering division, which executed the improvements to the processing machinery and equipment, implemented regular monitoring programmes, and graphically displayed the calculated energy usage per production output (per production/shift teams). This was done to keep everyone informed and to emphasise the highlights as well as where improvements and additional interventions were required.

A significant number of respondents noted that new income streams were created by selling off the process waste material as a by-product for further beneficiation. In addition, the minimisation of the process waste resulted in both reduced waste transport costs and subsequently levies at the landfill sites. The above findings are in line with the results from numerous research articles, such as those by Morrow and Rondinelli (2002) and Radonjič *et al.* (2015).

### 6.5. Can ISO 14001 EMS improve environmental awareness?

Almost all of the respondents agreed that the overall environmental awareness of their employees had improved since the implementation of ISO 14001. This corresponds with the research findings of Rondinelli and Vastag (2000), who noted that after the

company in their study, had been certified to ISO 14001, various beneficial impacts were observed. These included an improvement in the environmental awareness of employees and managers, as well as an increase in operational efficiencies such as longer production runs and fewer work stoppages. In this regard, the findings of this study resonate with the case studies of organisations such as PPC (ISO, 2011), which showed not only significant cost savings, but also improved employee awareness and interaction. However, although this study confirmed that open internal communication channels had been established and that continual improvement initiatives were becoming entrenched in the sampled organisations, not all the respondents were convinced that the enriched awareness had translated into an enthusiasm to make a difference amongst individual employees. Research by Poksinska *et al.* (2003) underlined the above benefits of companies of cost savings and improved employee awareness and also noted additional improvements such as external marketing benefits, which they identified as increased market share, enhanced corporate image, improved customer satisfaction and improved on-time delivery of products. A third combination of benefits, so-called relationship benefits, resulting from the implementation of ISO 14001 were described as enhanced interactions with neighbouring communities and improved relations with government departments (Poksinska *et al.,* 2003).

All the respondents agreed that the success of ISO 14001 was linked to the awareness and competencies that the organisation gained from implementing ISO 9001 as a quality management system, as well as the pro-active involvement of the organisation's management. Conversely, all the respondents thought that the EMS was expensive to implement and maintain, and all believed that outside of the Safety, Health, Environment and Quality (SHEQ) department, there was a general lack of understanding of the statutory and regulatory requirements related to the environment.

### 6.6 Did the implementation of an EMS result in financial benefits?

The respondents reported benefits such as a reduction and re-use of process waste and a reduction in the use of energy, as well as reduced levels of water usage in product processing in addition to the waste recycling initiatives. It was emphasised, however, that although the companies experienced the above as a result of the environmental programmes, the resultant cost savings did not necessarily show on their financial

statements due to the annual price increases for these utilities from the municipalities and Eskom. Another way to present the financial impact attributed to the EMS was to ascribe it to the improved production processes, which translated into longer production runs with fewer stoppages, reduced process waste, and a reduction in the virgin raw material used. An added significant impact on the financial bottom line was the new income stream generated by selling process waste as a by-product for further beneficiation. Supplementary interventions which resulted in cost savings were the installation of energy-efficient motors, drives and lighting; an effective machine maintenance programme; and the repair of steam, compressed air and water leaks.

The responses to this research project confirmed studies by Johnson (1997), which noted that ISO 14001 EMS helps to reduce a company's liabilities, control its costs, document its commitment to good corporate governance, and promote its responsibility and concern for the community it serves as well as the public at large. In studies conducted by Tarí *et al*. (2012) and Radonjič, Pisnik and Krajnc (2015), the authors argued that the benefits most identified by scholarly studies on ISO 14001 are process efficiency, environmental performance and organisational profitability. Poksinska *et al.* (2003) confirmed the value of environmental improvements as being internal process performance benefits such as increased productivity, improved employee morale, cost reductions, improved internal procedures and increased profit margins. A common response to this study was that a decrease in pollution (fewer emissions and the re-use of water and process waste) was evident, with most arguing that a reduction in waste had also been realised. In addition, the re-use of process waste had become a common practice, as had the recycling of waste. Some reported that there was an improvement in energy utilisation and that internal initiatives had been implemented to re-use process water. This resonates with the conclusions reached in other scholarly enquiries by researchers such as Hillary (2004), Zeng, Tian and Shi (2005), Link and Naveh (2006), Cañón and Garcés (2006), as well as Gavronski, Ferrer and Paiva (2008). The implementation of environmental programmes by companies is thus in compliance with clause 4.3.3 of ISO 14001, which requires that an organisation shall establish objectives and set targets as continual improvement initiatives. The findings in this study is therefore in agreement with Lin and Ho (2008), who also recommended that

organisations introduce improvement initiatives to minimise the negative environmental impact that their products and service activities may have.

Most of the respondents to this study believed that the implementation of ISO 14001 resulted in continued orders for their companies, particularly from their OEM clients. This was as per the findings of Sayre (1996), who posited that the effective implementation of ISO 14001 offers not only benefits that include the protection of the environment from the harmful effects of an organisation's services, products and activities, but also aids access to investment capital, reduces insurance costs, enhances a corporate's image, controls costs and improves market share. These findings are congruent with the conclusions from the PPC case study (ISO, 2011). That study found the cost benefits of business functions in 2009 per earnings before interest, taxes and amortisation (EBITA) of R2.5 billion: Research & Development = 14.3 per cent of costs; Procurement = 0.2 per cent of costs; Production / Operations = 1.3 per cent of costs as a result of streamlining the production process; and Marketing & Sales = 14.1 per cent of costs. This study's also indicates that small companies face similar costs to large ones, which could be a significant hurdle for smaller companies to adopt EMS as there is less income to write these costs off against.

No discrepancies were found between the responses from the surveys versus the interviews, which confirmed that the biggest financial benefit derived from ISO 14001 comes from recycling initiatives. The research also found that the main improvements were the reduction in processing waste due to improved production processes, a reduction in raw material costs, reduced energy and water costs, and the recycling of waste. Continual improvement initiatives have become a normal way of thinking in the sample companies, and regular two-way communication sessions are now conducted. The overall opinion of the interviewees was that ISO 14001 has been a success, which was demonstrated by the financial reports that highlighted the economic benefits. ISO (2004), however, cautions that the ultimate success of the system is dependent on an organisation-wide buy-in, including amongst top management.

The research revealed that the financial benefits of the EMS had a linear relationship with the type of product produced / economic sector and the consequent recycling initiatives. This was confirmed by the significant economic benefits seen as resulting

from the environmental interventions by companies in the automotive sector. The study also noted that the process waste had become a new income stream for some companies, as this by-product could be sold as a raw material to other downstream companies for further beneficiation. The research further revealed that the financial impact realised by companies in the automotive sector was enhanced by a drop in energy costs as a result of the installation of energy-efficient motors, drives and lights, as well as the effective management of machine maintenance and the subsequent repair of steam leaks, compressed air leaks and water leaks.

The foremost goal of most business enterprises is to make money, which is achieved by increasing their profits. In line with this, environmental considerations will usually be considered secondary. In the companies sampled for this research project, the initial consideration for ISO 14001 EMS certification was that it was seen as an aid to improve their corporate image with their customers, i.e. taking care of the environment in a responsible manner was not their primary motivator. This is as per authors such as Ofori *et al.* (2002) and Morrow and Rondinelli (2002), whose research underscored both the environmental as well as the financial values of the ISO 14001 standard. In general, the main motivation for ISO 14001 certification across the organisations sampled in the research project was primarily to gain a business advantage in its economic market - both international as well as local. The research further indicated that the two main drivers for certification for the sampled companies were either pressure from multinational clients or it was a corporate directive. The study feedback noted that the main environmental interventions from which the most obvious financial and economic benefits were derived were in the form of effective process waste management, water and energy conservation as well as general management.

Companies have realised that an EMS has to become an integral and permanent part of their daily business activities. Subsequently, many of today's organisations are demonstrating their commitment to preserving and managing the environment in their communities and around the globe by implementing an EMS that guides their organisational performance. The findings of this research have resulted in the conclusion that the effective implementation of an environmental management system to the requirements of ISO 14001 will result in financial and economic benefits to any organisation, irrespective of its size, geographic location or industry sector.

## 6.7 The barriers to implementation of ISO 14001

The main barriers to a successful implementation of ISO 14001 were found to be the high cost of implementation, the low awareness levels of legal requirements, a lack of management support, as well as the continued monetary investment needed to maintain the EMS.

### 6.7.1 Cost of implementation

Data obtained from the research study indicated that on average, an amount in excess of R 80 000 was required to implement an environmental management system to the requirements of ISO 14001, and then a further R 71 000 per annum was necessary to maintain it.

### 6.7.2 Management Support

Feedback from the survey as well as the interview noted that although top management took the decision to implement ISO 14001, it was however left to the SHEQ department and downstream line managers to execute it. These individuals felt out of the water as the "green" philosophy was a new concept in their overall day-to-day management. All the interviewees noted that time was a major impediment, as pro-active planning for training around the production programmes was needed for consistent EMS awareness sessions, internal audit training, report writing and cause analyses. In addition, the potential individuals for the 'EMS team' needed to be selected and trained – sometimes outside of normal working hours (as reported in Table 5.1 and commented in section 5.3).

### 6.7.3 Awareness of legal requirements

It was noted during the research that despite environmental information was being reported upon more and more in various media platforms, the general exposure levels of ordinary workers and managers were relatively low. As the general company "population" were exposed to the environmental philosophy and decisions of their companies, not only did their general environmental awareness levels increase, but also their awareness of the compliance obligations such as water management (usage, reuse,

recycling), waste management and energy management which were impacted by their company's operational activities.

### 6.7.4 Environmental Budget

When considering the factors impacting on the implementation and maintaining ISO 14001, it meant that a budget was needed to ensure that adequate funding was available to realise these objectives, as well as to cover expenses such as the purchase of environmental awareness posters, and monitoring and measuring key indicators such as the analysis of water samples. The findings of this research project concurred with those of Rukato (2000), who maintained that ISO 14001 is time-consuming and expensive, with a lengthy and costly registration process.

In order to maintain enthusiasm for, as well as the continual improvement and effectiveness of, the EMS, it has to be included in the day-to-day management of the organisation. According to Ammenberg and Sundin (2005), companies certified to ISO 14001 may become complacent and not adhere to the standards as they were originally intended.

## 6.8 What are the compliance issues associated with ISO 14001 EMS?

Virtually all of the respondents (92%) were convinced that their companies view environmental legal compliance as important, due to the fact that their activities have a significant impact on the environment. The setting of measureable environmental objectives linked to time targets, as well as the associated engineering programmes, are obligatory, due to compliance requirements instituted by local municipalities such as NMBM. For its part, from 2014, NMBM required a 10 per cent reduction in water use for businesses and households, while from 2013; Eskom demanded a reduction in electricity consumption of 10 per cent per annum. Further restrictions were placed on gas emission limits for pollutants such as sulphur dioxide ($SO_2$), nitrogen dioxide ($NO_2$), nitrogen oxides (NOx), carbon monoxide (CO), carbon dioxide ($CO_2$), ozone ($O_3$), volatile organic compounds (VOCs), benzene ($C_6H_6$), persistent organic pollutants (POPS) and particulate matter (PM), as set out in the National Environmental Management: Air Quality Act (NEMAQA) No. 39 of 2004. Waste management requirements were also stipulated in the Environmental Management Waste Act No. 59

of 2008 for the identification, storage, treatment, disposal, reuse, recycling and recovery of waste. As one interviewee explained, because South Africa is a water-scarce country, the Nelson Mandela Bay Municipality has instituted a stepped charging model for water usage, which adds a financial punishment for over-use.

In order to assess the effectiveness of the EMS, all the respondents conduct regular internal audits to the requirements of ISO 14001, which include legal compliance, in order to assess the effectiveness of the company in terms of compliance to the statutory, regulatory and other requirements as entailed in clause 3.2 of ISO 14001. These requirements include the local municipal regulations for effluent and storm water quality, national regulations for air emissions - for listed activities for which licences are required in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004);, and national requirements for the management of waste streams (classification, storage, processing, recycling disposal for which licences are required) in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

Additional regulations, which have a secondary relevance to environmental management, are the regulations of the Occupational Health and Safety Act (85 of 1993), such as GN 1179 - Regulations for Hazardous Chemical Substances (9A and 14); GN R155 – Asbestos Regulations; GN R236 – Lead Regulations; and GN R692 – Major Hazard Installation Regulations. The audit outcomes provide assurances that the organisations are compliant with the requirements of ISO 14001. The overall belief of the respondents and interviewees was that their implementation of the EMS was successful, and in addition to compliance, the financial benefits - such as cost savings due to efficiency improvements; recycling payback; sale of process scrap; reduced steam, water and electricity usage - could be verified by the inputs to the company's financial reports. In particular, while the EMS had been mainly implemented to keep their customers happy, the company realised additional benefits such as compliance with local by-laws and national legislation.

Lin and Ho (2008) postulated that companies can increase their competitiveness by showing their compliance with statutory and regulatory requirements and focusing on

the environmental concerns of their clients. Further, Engel (2008) stressed that South African companies had instituted significant improvements in environmental management over recent years by complying with the provisions of the applicable legislation, as well as by implementing company environmental policies that focussed on sustainable development.

## 6.9 Company size vs. cost savings realised

The survey responses showed that the financial benefits of an EMS are not dependent on the qualifications and/or years of experience of the people, who are responsible for implementation, i.e. the system itself drives the implementation and is transferable across different types of companies. The size of the company (i.e. the number of employees) also does not matter. In addition, the results indicated that the relationship between the size of an organisation (number of employees) and its cost savings is not linear, as larger companies do not necessarily show bigger cost savings than smaller ones. Furthermore, it was found that small companies face similar costs to large ones for the implementation and maintenance of an EMS. As this cost makes up a larger proportion of its income, it therefore suggests that it is financially more difficult for small enterprises to implement an EMS, which could be a major impediment for them. The research further indicated that the number of years of experience of the managers implementing the EMS and the cost savings realised are not directly correlated. Therefore, using experts to assist with implementing an EMS may be a good idea if internal expertise is lacking. Additionally, the study showed that some of the costs of an EMS are unavoidable, thus more experienced staff may not limit some of these costs.

## 6.10 Awareness benefits

According to the feedback from the respondents, the most important benefits of implementing ISO 14001 were cost savings and improved environmental awareness. Most of the respondents reported universal company scepticism, stating that the EMS had been forced upon them, particularly by the OEMs. However, a paradigm shift took place when the positive effects of the improvements were noted and the cost savings were quantified, such as a reduction in electricity and water usage which was evident from the municipal utility statements. Interviewees stated that the effectiveness of ISO

14001 was linked to the involvement of all staff in improvement initiatives and that everyone understood how she or he influenced the company's overall impact on the environment. This was evident by the new culture of actively segregating waste, switching off lights when leaving offices, environmental suggestion schemes and practicing effective housekeeping. Employee involvement was further enhanced as their new environmental awareness allowed them to contribute to their children's educational assignments. Evidence of improved awareness was reported in feedback from the survey questionnaires in Table 4.6 (12/13 or 92%) as well from the interviews in Table 5.1 (100%) where there was unanimous confirmation.

## 6.11 Waste management benefits and continual improvement interventions

As a result of the effective implementation of an EMS, continual improvement initiatives in the production processes led to a reduction in waste; the re-use of waste products back into themselves, such as rubber compound from the processing mills, or the production of other products; and recycling, such as used wooden pallets being sold to furniture manufacturers. The recording of process waste quantities has become part of the daily individual departmental measurable yardsticks. An example of one of these process improvement interventions is the batching-off of the rubber compound from the processing mills to thicknesses of less than 10 mm, which result in easier cooling and therefore subsequent scorching is prevented. Other initiatives have included the use of process water to flush toilets; reclaiming grey water from the showers and wash basins and using it to water the garden and lawns in the yard; and the use of grease instead of oil to lubricate machines, which is both a cost saving and reduces incidences of contamination of the process water. Further initiatives include filtering used solvents to clean parts and machines; selling boiler ash as a filler raw material for the production of bricks; treating waste oil for re-use in the production process of base oils; and installing automated production processing systems to increase efficiencies. Finally, companies have reported setting geyser temperatures at 50° Celsius; installing light emitting diode (LED) lamps and motion sensors in offices; installing energy-saving shower heads; and replacing fuel-burning lift trucks with battery-powered or liquefied petroleum gas (LPG) units to reduce emissions.

## 6.12 Environmental Management Programmes (EMPrs)

Below is a summary of the EMPrs that were implemented by the companies under study to achieve their EMS objectives:

**Water saving initiatives:**

The use of process water to flush toilets and the installation of water-saving showerheads in ablution blocks. A water-leak management programme to prevent wastage and preserve a scarce natural resource was also initiated, while hydrocarbon solvents were replaced with water-based products. This was in addition to the use of water-based, bio-degradable cleaning chemicals and the reclaiming of grey water from the showers and wash basins for use on the garden and lawns.

**Energy saving initiatives:**

The installation of clear roof sheeting to facilitate daylight harvesting, resulting in a reduction in electricity use; a steam management programme was instituted that checks for and fixes steam leaks, coupled with the lagging of steam pipes to retain heat and conserve energy; and drive motors and gears were synchronised to ensure efficient energy management. Concomitant with this was the introduction of staggered start-up times for machines and equipment to reduce energy spikes and manage peak-hour demand effectively, as well as the optimisation of machine cycle times to ensure efficient production runs and the use of reduced-output compressors to conserve energy. Additional programmes included the installation of energy-saving lighting such as LEDs; planned maintenance programmes for machines and equipment to ensure their reliability and optimal functionality; the lowering of geyser temperature settings to 50° C in order to reduce electricity use; and the installation of motion-sensor light switches in offices. Other initiatives included replacing diesel/petrol powered forklift trucks with battery/gas powered machines to reduce emissions; lubricant recovery; and replacing oil with grease as a machine lubricant.

**Recycling initiatives:**

The collection of e-waste for the environmentally-friendly disposal and recovery of precious metals; the recycling of non-ferrous waste; the recycling of food waste by composting or removal by pig farmers; the separation of waste into streams; deliberate initiatives to reduce, reuse and recycle waste; and the sale of process waste for further beneficiation.

## 6.13 General discussion

The individuals responsible for the EMS in the sample companies all had an adequate awareness and understanding of ISO 14001 and the requisite statutory and regulatory requirements. It was clear from the research data that the most significant cost benefits were related to the production output and the resultant recycling initiatives. This was directly linked to the fact that the production process waste could now be sold as a by-product and therefore generate a new income stream. The biggest financial benefits were realised by companies in the automotive sector. The study data indicated that the main drivers of these substantial cost benefits were improved production processes, which led to reduced waste and waste recycling initiatives. Related to the above were reduced energy costs, which were brought about by engineering interventions such as: the installation of energy-efficient motors and gear drives; the installation of LED lighting, an effective machine maintenance programme, and the regular inspection and repairing of steam, compressed air and water leaks. The respondents indicated that the extent of the financial benefits of the EMS was not dependent on their qualifications and/or years of experience, but rather the product type and ensuing recycling initiatives. It was clear from the study that neither the company size (based on the number of employees) nor the geographical location had a significant bearing on the total annual cost savings of the companies. The results show that the most significant cost benefits were achieved by four companies that supplied to the OEMs, the reasons for which were postulated as being a reduction in process waste; recycling initiatives; the sale of processing waste; a reduction in raw material costs; and a reduction in energy costs.

It was also clear from the feedback that the achievement of the EMS was linked to the expertise which had been gained from managing the ISO 9001 quality management system, which ensured that the appropriate training of employees was planned, as well as the interaction of employees in programmes and suggestion schemes to ensure continual improvement. From a cost perspective, the research confirmed the opinion of the respondents that ISO 14001 is expensive to implement and maintain.

## 6.14 Conclusion

The benefits of the EMS are directly related to the way in which an organisation implements the ISO 14001 standard. All the sampled organisations reported a variety of benefits, which included, *inter alia*, improved environmental performance; improved processing efficiencies; greater cost reductions; improved employee awareness at all levels of the organisation; and an enhanced corporate image. Further, it can be seen that ISO 14001 provides organisations with an understanding of what their environmental commitments are.

ISO 14001 requires continual improvement as a continuum, i.e. it is a never-ending process, and however its effective implementation will result in improved interactions between an organisation's production processes. Concurrently, ISO 14001 will challenge an organisation's paradigm regarding the traditional raw materials utilised as well as its use of water and energy. The research also indicates that ISO 14001 will simultaneously confront the organisation to reduce, reuse and recycle its waste which will ultimately result in financial benefits, irrespective of a company's size, geographic location or industry. The results of this research project therefore concur with the scholarly studies outlined in Chapter 2, which suggests that the effective implementation of ISO 14001 will ultimately result in a generally positive environmental, reputational and financial impact on an organisation.

# CHAPTER 7: Conclusion

## 7.1 Introduction

The objectives of this research project were to assess the financial benefits which accrued to companies in the South African manufacturing sector that had implemented an EMS such as ISO 14001. This chapter focuses on a conclusion and recommendations based on the previous chapters, in order to achieve the objectives of the research.

Advantages such as economic benefits and better environmental performance have been touted by South African companies after implementing ISO 14001 EMS. Although these benefits, which include cost savings realised from the reduction of process waste; the more efficient use of resources such as electricity, water, steam, gas and fuels; the purchase of environmentally friendlier raw materials; as well as the reuse, reduction and recycling of process waste, can be listed, the actual commercial impacts have not been calculated so as to rationalise the monetary outlay to manage the EMS.

Despite numerous scholarly studies on the impact that the implementation of ISO 14001 as EMS has had in improving an organisation's overall performance, including environmental, operational and financial metrics, very little published work is available on the financial and other benefits that accrue to South African organisations that have implemented an EMS based on the requirements of ISO 14001.

The aim of this study was thus to assess the direct financial benefits accrued by companies by their EMS, such as cost savings realised as a result of: (i) purchasing environmentally friendlier raw materials; (ii) the reduction of process waste and the more efficient use of resources such as electricity, water, steam, gas and fuels; and (iii) the reduction, reuse and recycling of waste.

## 7.2 Limitations of the study

The number of companies that have been certified to ISO 14001 is relatively small, and they are not widespread across the South African manufacturing spectrum. In addition,

it was noted during the research that many of the organisations in the study sample were either owned by international companies or had partnerships with international companies, which may have influenced their views or opinions regarding the environment.

The study engaged with 18 South African companies that were active in the manufacturing sector across three metros and one city. The selected companies had all been certified to the requirements of ISO 14001 by accredited certification bodies, such as the South African Bureau of Standards (SABS). Of the 18 companies that were invited to partake in the study, 13 (72 per cent) completed and returned the questionnaires. Despite numerous attempts to encourage the representatives of the other companies to complete the survey, this was not forthcoming.

For this research project, the data were gathered in two phases as a mixed methods research design was used. The quantitative method was employed for Stage One, where a survey questionnaire consisting of both closed- as well as open-ended questions was forwarded electronically to selected participants for completion. Of the 18 questionnaires sent out, 13 completed responses were collected and evaluated using statistical methods. These were presented in a graphical format, from which logical interpretations, assumptions and advice could be formulated.

In Stage Two of the research project, 10 out of the 13 survey respondents (77 per cent) were selected for one-on-one, structured interviews. This was done in order to glean more information which may have been missed in the questionnaire responses as a result of interpretational misunderstandings of the questions. The feedback was collected and compared with the data obtained from the survey so that a comprehensive and inclusive evaluation could be completed.

## 7.3 Problem statement

Various scholarly studies, such as one by Campos *et al.* (2015), note that ISO 14001 has resulted in improved overall management performance (according to environmental, operational and financial indicators) for companies. Other associated research

investigations conducted in Brazil, Russia, India, China and South Africa (Campos & Melo, 2008; Perotto *et al.,* 2008) have concurred with the above (ISO/Survey, 2015). Yet despite a study by Matela (2006) that looked at the effects of ISO 14001 on environmental performance, no published research has been conducted in South Africa on advantages such as improved productivity, waste reduction, reduced energy usage, a decrease in the use of natural resources, the reuse of scrap material and the recycling of waste, which could quantify the financial advantages for South African organisations that adopt ISO 14001. For this reason, the goal of this study was to determine if the adoption of an EMS based on ISO 14001 makes good business sense, and to quantify the financial benefits associated with the implementation of an EMS in various selected manufacturing companies.

## 7.4 Resolution of the Research Questions

**Research Question 1: What drove the observed companies to implement an ISO 14001 EMS?**

The results showed that a significant number of respondents indicated that the main motivation for implementing ISO 14001 as an EMS was that it was a corporate imperative; for less than half of the respondents, the motivation was a customer requirement. These responses were corroborated by case study findings from organisations such as Pretoria Portland Cement (ISO, 2011), as well as pronouncements from OEM customers such as Ford Motor Corporation (Ford, 2001) and General Motors (GMSA, 2009a and GMSA 2009b). In addition, the majority of respondents were of the opinion that top management was the main driver of the success of the EMS in their organisations. The results therefore validate the research as discussed in the literature review.

**Research Question 2: Did the implementation of an EMS improve process efficiency?**

The majority of the survey questionnaire and interview responses mentioned numerous improvements, such as a reduction in the consumption of a natural resource like water;

less process waste generated; a reduction in energy usage; a more efficient use of energy resources, i.e. electricity, steam, gas and fuels; and the reduction, re-use and recycling of waste. The above indicates that companies showed improved operational performances after having implemented ISO 14001. The reduction in waste resulted in lower waste transport costs as well as reduced levies at the landfill sites, and the re-use of process waste was now in place, thereby reducing the need for virgin raw materials. A significant response was that a new income stream was created, as the process waste material was now sold as a by-product for further beneficiation. The feedback relating to research question 2 corroborates the results from numerous research articles, such as those by Morrow and Rondinelli (2002), Radonjič *et al.* (2015) and others.

**Research Question 3: Did the implementation of an EMS improve environmental awareness within the companies under study?**

Almost all of the respondents agreed that the overall environmental awareness of their employees had improved since the implementation of ISO 14001, which ties in with the research findings of Rondinelli and Vastag (2000) that after a company is certified to ISO 14001, the following impacts are recognised: an improvement in the environmental awareness of employees and managers; an increase in operational efficiencies; and an improvement in the overall operational effectiveness of the organisation. However, not all the respondents to this study were convinced that the awareness amongst these individual employees had translated into an enthusiasm to make a difference.

Eighty five per cent of respondents believed that the implementation of ISO 14001 had resulted in continued orders for the company. This is in line with the findings of Sayre (1996), who posited that the effective implementation of ISO 14001 offered benefits such as the protection of the environment from the harmful effects of an organisation's services, products and activities; satisfying the criteria set by investors and therefore enhancing access to investment capital; the reduction of insurance costs; an enhanced corporate image; improved control of costs; an improved market share; the successful fulfilment of the certification criteria of suppliers; the limiting of liabilities; the improved conservation of resources; the provision of effective development; and the transfer of technology.

The feedback for research question 3 regarding an improved environmental awareness thus corroborates the various studies cited in the literature review.

**Research Question 4: Did the implementation of an EMS have financial benefits?**

When considering the financial benefits realized as a result of the effective implementation of ISO 14001, including a reduction in processing waste; a reduction in the use of energy sources such as electricity, steam, gas and fuels; a reduction in water usage; and the re-use, reduction and recycling of waste initiatives, every respondent believed that the overall financial impact was positive, and all selected more than one of the proposed indicators. The respondents proposed that the main drivers of the cost savings were the reduction in waste as a result of improved production processes; the recycling of waste which is now sold as a by-product for further beneficiation; the reduction in raw material costs due to the lessening of process waste; and the reduction in energy costs by installing energy-efficient motors, drives and lighting, as well as an effective machine maintenance programme and the repairing of steam, compressed air and water leaks. The responses confirmed Johnson's (1997) findings that ISO 14001 EMS helps to reduce a company's liabilities; control its costs; document its commitment to good corporate governance; and promotes its responsibility and concern for the community it serves as well as the public at large. Tarí *et al*. (2012) argued that the benefits most identified by scholarly studies on ISO 14001 are process efficiency, environmental performance and organisational profitability. In addition, Poksinska *et al*. (2003) confirmed the combined paybacks of environmental improvements as being:

- internal process performance benefits - increased productivity, improved employee morale, cost reductions, improved internal procedures and increased profit margins;
- external marketing benefits - increased market share, enhanced corporate image, improved customer satisfaction, improved on-time delivery of products; and
- relationship benefits - enhanced interactions with neighbouring communities and improved relations with government departments.

The above deductions are similar to the conclusions reached in other scholarly inquiries by researchers such as Hillary (2004), Zeng, Tian and Shi (2005), Link and Naveh

(2006), Cañón and Garcés (2006), as well as Gavronski, Ferrer and Paiva (2008), as elaborated upon in the literature review in Chapter 2.

All four of the research questions were adequately and comprehensively covered in the survey questionnaire, which incorporated information-type; category; multiple choice and open-ended questions. In addition, follow-up interviews were conducted on a selected sample of respondents in order to elicit further information to confirm and expand on the results of the survey questionnaire.

## 7.5 Recommendations

Resulting from the study, the subsequent advice and guidelines may be offered.

### 7.5.1 Dissemination of information relating to the success of an EMS

It is imperative that information regarding the positive financial benefits that can be reaped by implementing an EMS in a company is shared, as this will allow others to build on the gains achieved by the trailblazer organisations who have initiated an EMS implementation. Some of this can already be seen in the interventions of the Automobile Industry Development Corporation regarding energy efficiency improvements for companies operating in the automotive sector. Business chambers can also play a meaningful role as a platform for sharing this information across the spectrum of its associate members, and by encouraging the formation of industrial associations to share ideas and resources. An example of this could be through by-product exchanges, where companies utilise each other's by-products as raw material feedstock. As noted by Gagnier and Smith (2006), the vision of ISO is centred on international co-operation, which, they posited, is for the global good; the idea that the ISO standards contribute universally in a positive manner to the world-wide well-being of all people; and that ISO standards has been proven to be catalysts of international trade.

### 7.5.2 Acknowledgement that financial benefits are nuanced

It must be noted that the financial impact was an estimation, as actual numbers were not always available. This was because not the all details of pricing were reported or

considered, as production processing is a continuum and new development work is normally scheduled as part of a daily schedule. In addition, the cost saving calculations for energy usage, processing machine upgrades and waste reduction were not completed in minute detail. Therefore, as the green revolution is gaining momentum and companies are encouraged (or nudged) to implement an EMS, they need to develop and promote the use of innovative management accounting systems and practices that will facilitate the inclusion of environmental costs and benefits in financial reporting. In addition, many companies outsource their non-core functions, such as specialist engineering functions like electronics and robotics, to external contractors, who are able to provide valuable inputs into processing upgrades and energy optimisations. These contractors should be recognised and compensated for these initiatives and recommendations, which include energy savings, improved water conservation, and improved productivity and efficiency.

### 7.5.3 Encourage employee innovation

As noted from the feedback discussed in Chapters 4 and 5, the overall opinion of the respondents was that the success of ISO 14001 was intricately connected to the newly-gained awareness and commitment of management, which had a positive influence on everyone in the organisation, resulting in employee involvement in continual improvement programmes and suggestion schemes, and contributing to improved housekeeping. A comment from Interviewee 9 describes the attitude of their company employees as: *"…the EMS has now become a family affair, as employees are using the awareness information and continual improvement initiatives for their children's school assignment projects – we know the effort is worth it"*.

Organisations must therefore consider different and simple ways to encourage innovative suggestions for improving the environment. These can take the form of an incentivised suggestion scheme where an employee is rewarded when her or his suggestion leads to a financial benefit and/or improved environmental performance. The reward could be financial such as cash or a voucher, merchandise or both, as determined by the organisation.

### 7.5.4 Lobby for tax rebates

The findings of this research may provide positive incentives for other South African organisations to seek ISO 14001 certification, as the effective implementation of an EMS with the concomitant benefits to society may serve as motivation to lobby government to provide incentives such as tax rebates to these organisations. This may help smaller organisations for which implementing an EMS is relatively expensive. As it is imperative that green thinking becomes a way of life for individuals as well as companies, both large and small, the possible incentive of tax rebates will be very encouraging to businesses, as it will assist them to cover the cost of implementing an EMS, as well as inculcate a green philosophy in the business thinking of enterprises. As indicated by the research, the cost factor of implementing an EMS may be a constraint, therefore tax incentives will rule out the excuse of not including an EMS in the business strategy of a company.

### 7.5.5 Implement training cost subsidies

The adequate training of staff to improve environmental awareness is essential to the effective implementation and continual maintenance of ISO 14001, yet the cost of training makes up a substantial proportion of the overall financial impact related to the implementation of the EMS. The ISO 14001 standard recommends that applicable training be affected throughout the organisation; however these courses are not cheap as they are provided by private enterprises that do business to make a profit. It would therefore be beneficial to organisations if government would allow companies that train their employees and management to the requirements of ISO 14001 to claim the costs from the Skills Development Levy (SDL), or alternatively, to allow the private training institutions to claim the rebate from the SDL and pass this on by offering the training service to organisations at a reduced rate.

Implementing an environmental management system is becoming a growing reality for many companies, and its associated jargon brings relatively new concepts into the vocabulary of employees. South Africa is a multi-lingual society with 11 official languages, but the *lingua franca* of business is English, which is not the first language of the majority of people in most organisations. Future research may thus be required to

study the significance of providing environmental awareness training in the local vernacular of employees.

## 7.6 Recommendations for further research

The research indicates that the organisations in the study generally implemented ISO 14001 as a voluntary initiative, driven by either a boardroom decision or their customers in the market. At the same time, governments all over the world – including South Africa – are supporting global initiatives to protect the environment by preventing pollution, reducing greenhouse gases and minimising the depletion of natural resources such as water. This philosophy is gaining momentum, and it may be that stricter environmental regulations are enforced. Future research could, therefore, focus on how businesses would be impacted if ISO 14001 certification became mandatory.

## 7.7 Conclusion

This study found that ISO 14001 certification for the organisations sampled resulted in them attaining a competitive advantage in the markets in which they operate. The most significant financial benefits were derived from the improved management of processing waste, as well as the conservation of natural resources such as water and the more efficient use of energy sources. The organisations that were part of the research sample provided information which, when analysed, demonstrated their commitment to preserving and managing the environment, and informed the conclusion that the implementation of an environmental management system to the requirements of ISO 14001 will result in financial benefits for any organisation.

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## Appendix 3.1: Invitation to participate in study

**Title: THE EFFECT OF ISO 14001 ON ENVIRONMENTAL MANAGEMENT STRATEGIES IN THE SOUTH AFRICAN MANUFACTURING SECTOR**.

My name is *Lawton Warren Johnson*. I am a postgraduate student at the University of South Africa under the supervision of Ms Tracey McKay, who is a staff member and Senior Lecturer at UNISA. The research forms part of my MASTERS degree.

**Introduction**

The primary aim of the research is to analyse and quantify the cost/ benefits, which the successful implementation of an EMS has had in various manufacturing companies, certified to ISO 14001.

**Invitation to participate**

This is an invitation to you to participate in the study.

**What is involved in the study?**

Your involvement in the study would be that of being a participant in a questionnaire survey. The process will not be a long one and should take a maximum time of 30 minutes.

**Risks**

While nothing in life is risk free, there are, for all intents and purposes, no financial, ethical or moral risks involved in participation.

**Benefits**

You could find participation beneficial in that it may clarify for you some of the issues pertaining to the financial benefits of implementing an EMS in your industry. As a participant, you will be sent the results upon completion of the research if you so indicate.

**Participation is voluntary**

The refusal to participate will have no penalty or loss of benefits to which the participant is otherwise entitled, and that the participant may discontinue participation at any time without penalty loss of benefits to which they are otherwise entitled.

**Reimbursements**

There are no reimbursements.

**Confidentiality**

All personal information will be kept confidential and there will be no personal ramifications of any results found. Results will be captured in a manner that will ensure confidentiality.

**Contact details of researcher**

Please contact me directly on: 072 855 7859 or lawton.johnson@sabs.co.za

For further information you can contact my supervisor, Ms Tracey McKay on:

073 264 9496 or 011-670-9461 or mckaytjm@unisa.ac.za

**Appendix 3.2: Consent Document**

**THE EFFECT OF ISO 14001 ON ENVIRONMENTAL MANAGEMENT STRATEGIES IN THE SOUTH AFRICAN MANUFACTURING SECTOR**.

I confirm that I have been informed about the above study by *Lawton Johnson*.

I have also received, read and understood the study as explained in the participant information form.

I understand that my all personal details (identifying data) will be kept strictly confidential.

I understand that I may, at any stage, withdraw consent and participation in the study.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

The research protocol above has been explained to me

(name).....

Participant Signature.....
Date.....

Witness Signature..... Date.....

Witness Signature..... Date.....

**Appendix 3.3: Survey Form**

**Name:** **Company Name:**

**Job Title:** **Date:**

| | | |
|---|---|---|
| **A.** | **Background** | |
| 1) | Where is your company located? | |
| 2) | How many employees do you have? | |
| 3) | Which type of industry sector is your organisation? (*please circle your answer*) | Chemical / Engineering / Rubber & Plastics / Food / Automotive / Other |
| 4) | How long have you been working in the EMS field? | |
| 5) | Do you have formal qualifications in the environmental field? (Diploma / Degree) | a. Yes b. No |
| 6) | Please describe the specific EMS training which you have attended? | |
| **B.** | **EMS Implementation** | |
| 7) | Which management system have you established in your organization? | |
| 8) | Have the above system/s been certified? | a. Yes b. No |
| 9) | If yes, by which certification body? | |
| 10) | What was the most important rationale for certification? | |
| 11) | Did you or are you employing a consultant to assist you? | a. Yes b. No |
| 12) | Was the implementation successful? | a. Yes b. No |
| 13) | Who is responsible for ISO 14001 implementation in your company? | |
| 14) | What is the main driver of ISO 14001 implementation in your company? | a. Top management<br>b. Employees<br>c. Customers<br>d. Consultant/s<br>e. Other/Don't know |
| **C.** | **Advantages** | |
| 15) | How would you rate the success of ISO 14001 implementation in your company? | a. Failed<br>b. Effective<br>c. Can't tell |
| 16) | If the answer to (16) the above was "Failed", what were the reasons for the failure? | a. Lack of experience<br>b. Lack of employee training<br>c. Lack of planning<br>d. High cost of certification<br>e. Inadequate management involvement<br>f. Don't know |

| | |
|---|---|
| 17) If the answer to (16) the above was "Effective", what were the reasons for the success? | a. Experience with other management systems<br>b. Management commitment & involvement<br>c. Effective training of employees<br>d. Employee involvement |
| 18) How has ISO 14001 impacted on your company's overall environmental performance? (*you can select more than one answer*) | a. Decreased pollution at production processes<br>b. Waste reduction<br>c. Re-use of waste<br>d. Recycling of waste<br>e. Increased productivity<br>f. Reduction in cost<br>g. Increased market share |
| 19) Can you quantify the financial value in your answer/s to (18) above in Rand per annum? | a<br>b.<br>c.<br>d.<br>e.<br>f.<br>g. |
| 20) Has the attitude of your employees w.r.t. to the environment changed since the implementation of ISO 14001? | a. No change<br>b. Some change<br>c. Substantial |
| 21) If yes, how? | |
| 22) If no, why? | |
| 23) Do you think that the implementation of ISO 14001 resulted in increased orders? | a. No increase<br>b. Some increase<br>c. Substantial increase |
| 24) Has the implementation of ISO 14001 resulted in improved overall management? | a. No improvement<br>b. Some improvement<br>c. Substantial improvement |
| 25) Please quantify in Rand value your answer to (24) above | |
| | |

| | | |
|---|---|---|
| **D.** | **Barriers** | |
| 26) | What barriers have you encountered with ISO 14001 implementation? | a. High monetary investment required<br>b. Certification takes long to implement<br>c. Management not aware of barriers<br>d. Ignorance of regulations / legal requirements<br>e. Can't tell |
| 27) | What is your perception regarding the difficulty of obtaining ISO 14001 certification? | |
| 28) | Is maintaining an EMS expensive? | a. Yes b. No |
| **E.** | **Compliance** | |
| 29) | Does your company regard environmental principles as important in its operations? | a. Yes b. No |
| 30) | Do your company's activities have an impact on the environment? | a. Yes b. No<br>c. Can't tell |
| 31) | Are these impacts positive or negative? | a. Positive<br>b. Negative<br>c. Can't tell |
| 32) | Do you conduct Internal Audits of your system and processes for the EMS? | a. Yes b. No |
| 33) | Are you coping with the added responsibility of an EMS? | a. Yes b. No |

**Appendix 3.4: List of possible participants**

| **Company Name** | **Location** | **Industry Sector** | **Contact Person Job Title** |
|---|---|---|---|
| Acoustex | Port Elizabeth | Rubber & Plastics | QA Manager |
| Arkema Resins | Durban | Chemical | HSE Manager |
| Braceable | Durban | Mechanical | HSE Manager |
| Bridgestone | Port Elizabeth | Tyres | SHEQ Manager |
| Coca Cola | Port Elizabeth | Beverages | SHEQ Manager |
| Dana Spicer Axle | Uitenhage | Mechanical | Eng. Manager |
| Data Dot Technologies | George | Microdots | Senior Manager |
| Eveready | Port Elizabeth | Batteries | Eng. Manager |
| Evonik | Port Elizabeth | Carbon Black | HSE Manager |
| Floorworx Africa | East London | PVC Flooring | Systems Manager |
| General Motors SA | Port Elizabeth | Automotive | Env. Engineer |
| Industrial Oleochem. Products | Durban | Chemical | SHEQ Manager |
| Kansai Plascon | Port Elizabeth | Coatings | HSE Manager |
| Linde & Wiemann | Port Elizabeth | Auto Components | HSE Manager |
| Mecer/Mustek | Port Elizabeth | Computers | Ops Manager |
| PPC | Port Elizabeth | Cement | Safety Manager |
| Shatterprufe Neave | Port Elizabeth | Automotive Glass | SHE Manager |
| Shatterprufe Struandale | Port Elizabeth | Automotive Glass | SHE Manager |
| Toyota South Africa | Durban | Automotive | SHE Manager |
| Veyance Technologies | Uitenhage | Conveyor Belts | Plant Engineer |

## Appendix 3.5: Ethical Clearance Letter

UNISA university of south africa

1st December 2015

Dear Mr Johnson

CONGRATULATIONS

We want to congratulate on reaching an important milestone, namely **ethics approval for your study**. Please always quote the ethics code: **2015/CAES/115**.

**A.** Please ensure that you are fully aware of the following UNISA policies and processes:

1. UNISA policy on M and D degrees
2. UNISA procedures on M and D degrees

Make sure you have read these documents. If there are any sections that need clarification, please let me know.

**B.** In addition, before you can proceed to register for the next module **[DFENM91]**, we need to sign a supervision agreement. It is very complicated, please see attached and complete it as best as you can and email it back to me by **Monday the 7th of December 2015**.

**C.** Please take note of the important information in the Appendix 1 pertaining to funding. Any additional information regarding funding should be requested from: (1) Refilwe Makgae Tel: 012 441 5608 (2) Morgan Mashweu Tel: 012 441 5607 or (3) Jo Mphogo Mashweu Tel: 012 441 5601. They all use the following email address: DSF-postgrd@unisa.ac.za IT IS YOUR RESPONSIBILITY TO DRIVE THE FUNDING PROCESS.

**D.** Free training offered by UNISA: It is expected of you to avail yourself for the following training sessions offered by UNISA. They usually (but not always) take place on weekends.

- Academic writing
- Conceptualising, researching, structuring and writing a good dissertation
- Library resources for research purposes
- Research design
- Questionnaire surveys and Atlas ti
- Interviewing skills
- Rigor and ethics in research
- Writing a good dissertation/thesis
- Analysing qualitative and quantitative data
- Quantitative data acquisition
- Literature review

Any queries/bookings and other information pertaining to training should be taken up with the following people:
Dr Lawrence Sithole, Research Training Leader, E-mail: sitholl@unisa.ac.za, Tel: 012 429 2520
Ms Susan Mkansi, Research Administrative Assistant , E-mail: Mkansst@unisa.ac.za, Tel: 012 429 3911Ms Tintswalo Mathebula, Research Administrative Assistant, E-mail: matheta@unisa.ac.za, Tel: 011 471 2308

Yours sincerely, and on behalf of myself and Deborah Machard

Tracey McKay, Department of Environmental Sciences, College of Agriculture and Environmental Sciences, Tel: (+27 11) 670-9461 mckaytjm@unisa.ac.za

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

## Appendix 3.6: Budget

As tabulated in Table 3.1 below, the researcher spent R 9000-00 for the purchase of data for internet access and the sending and receiving of emails, as well as for telephone calls (both fixed line as well as mobile). For overall travel expenses as well as attendance at the South African Society of Geographers 100th anniversary conference at the University of Stellenbosch in September 2016, an amount of R 17 000-00 was allocated. The cost incurred for the purchase of hard copies and electronic journals/periodicals; professional services, i.e. consulting for data assessment, presentation and interpretation of data amounted of R 5500-00. For language editing, layout editing and professional typing of thesis, and the binding of documents for submission, the cost allocated was R 8000-00 and finally the submission of copies of bound thesis and electronic copies cost R 2000-00, all of which totaled R 41 500-00.

**Table 3.1: Expense breakdown**

| **Cost Item** | | **Estimated Cost (Rand)** |
|---|---|---|
| (i) | Data for internet access and sending/receiving of emails | 4000 |
| (ii) | Purchase of hard copies and electronic journals/periodicals | 3500 |
| (iii) | Travel expenses | 5000 |
| (iv) | Telephone expenses | 5000 |
| (v) | Professional services, i.e. consulting for data assessment, presentation and interpretation of data | 2000 |
| (vi) | Language editing | 3000 |
| (vii) | Layout editing | 1500 |
| (viii) | Professional typing of thesis | 1500 |
| (ix) | Binding of documents for submission | 2000 |
| (x) | Attendance at conference | 12000 |
| (xi) | Submission of copies of bound thesis and electronic copies | 2000 |